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THE INTERNATIONAL SUGAR·JOURNAL

A·TECHNICAL·&·COMMERCIAL PERIODICAL·DEVOTED·ENTIRELY TO·THE·SUGAR·INDUSTRY

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NOVEMBER, 1959

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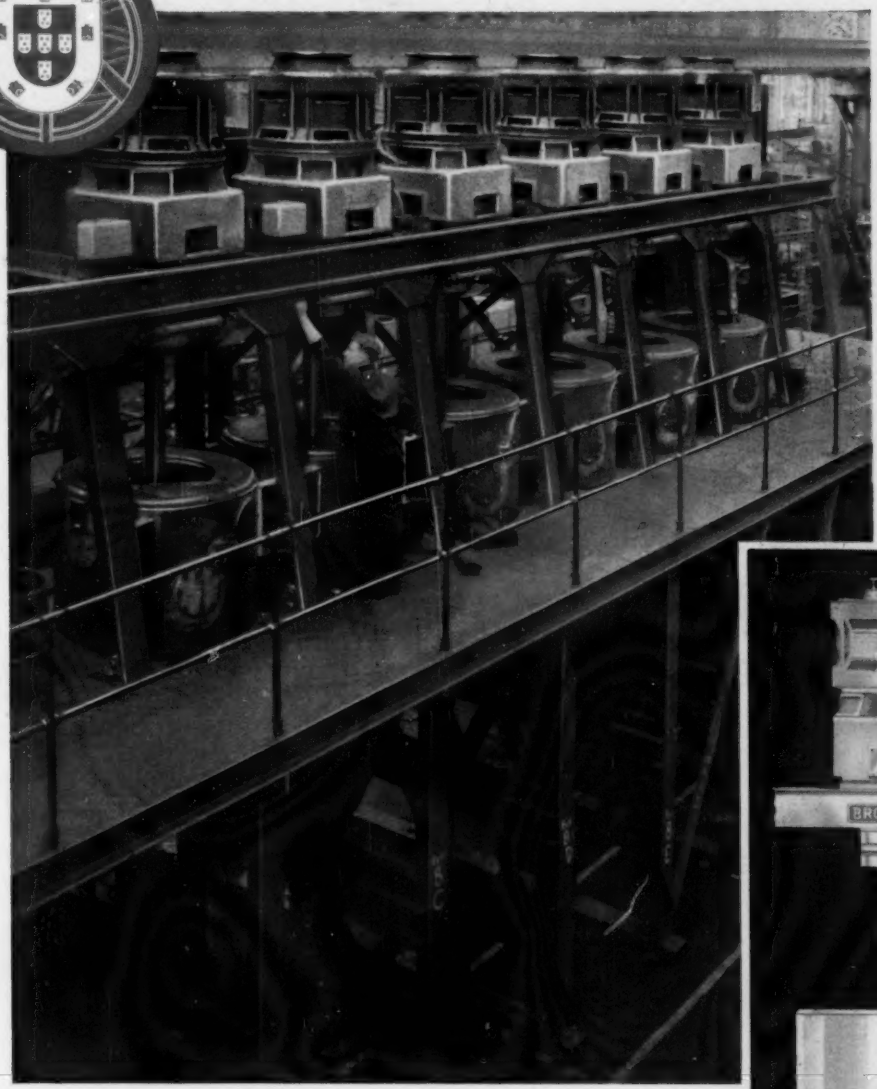

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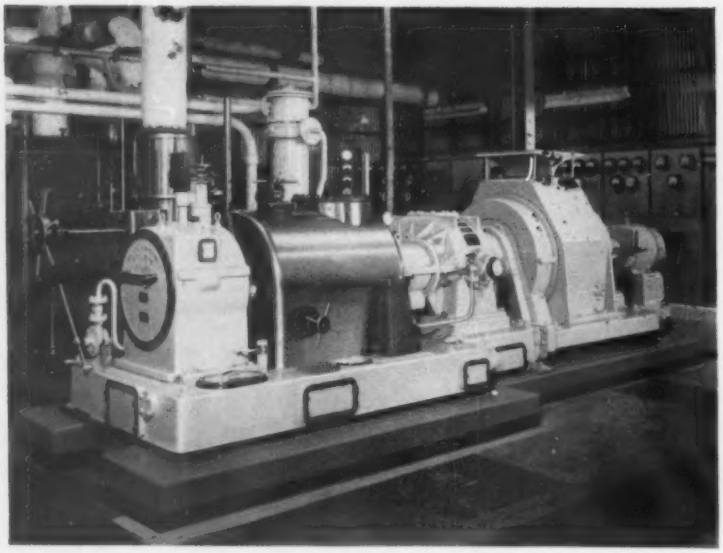

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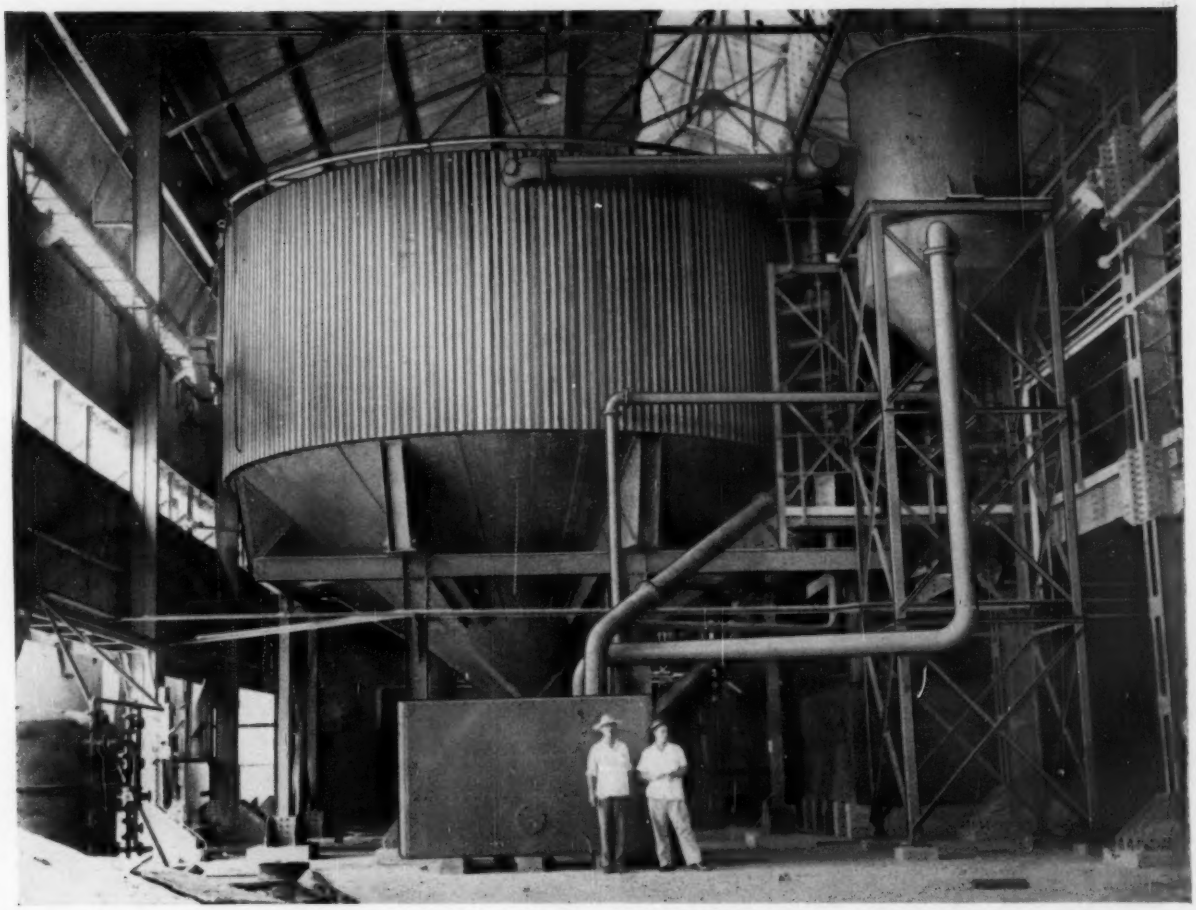

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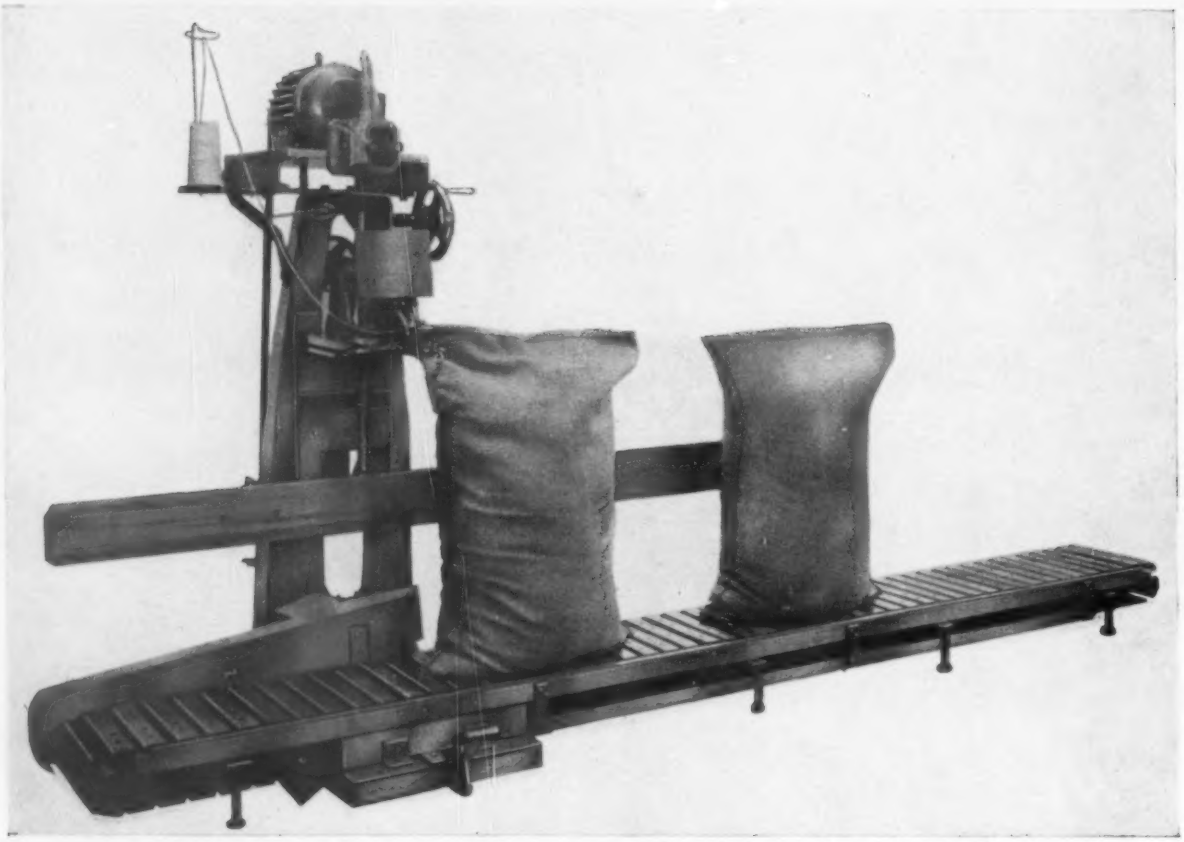

This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

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Because of its extremely high sensitivity the automatic polarimeter is able to utilise a much shorter sample cell length. This feature will be of particular interest to those industries which handle light absorption solutions which until now could only be measured for optical activity with difficulty by visually balanced instruments.

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GRILL FLOOR flooring surrounding pressure vessels at Heinz, Harlesden factory, London.

GRILL walkways

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★ *They're not expensive*

★ *They're built for the job, and when it comes to rugged strength*

you can't beat the Markham specification!

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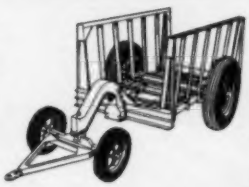
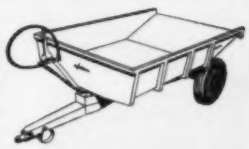


For constructional jobs, road making, etc., this 3-ton hydraulic tipping 'Dumper' trailer is a winner; very strongly made, it will give years of service under the most arduous conditions.



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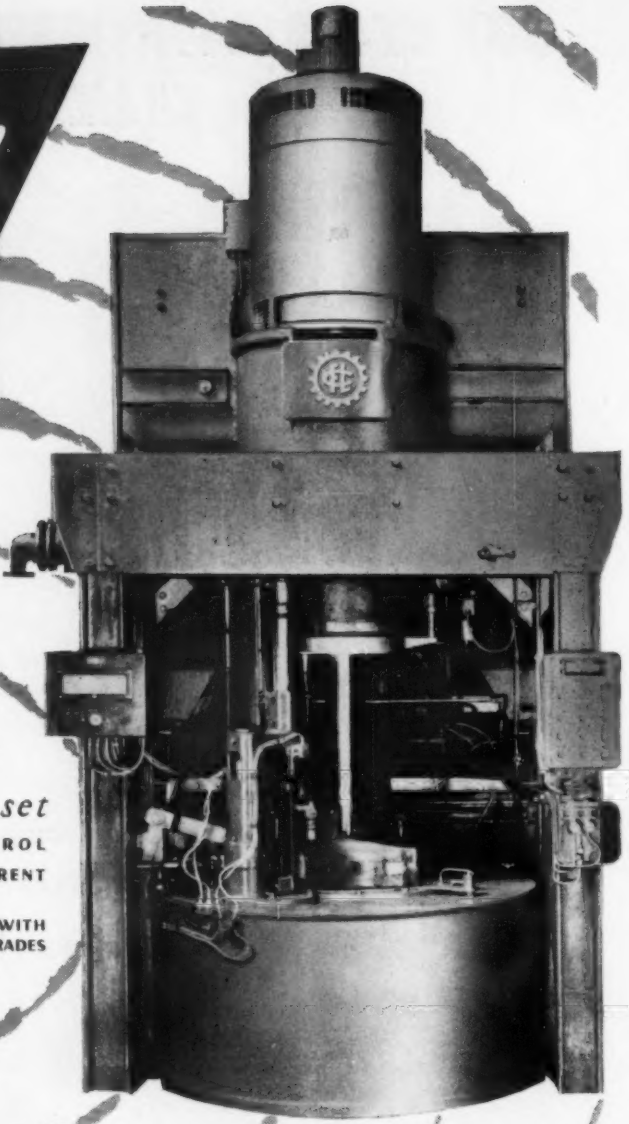

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

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FIVES LILLE - CAIL

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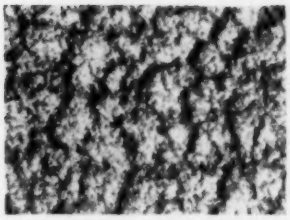
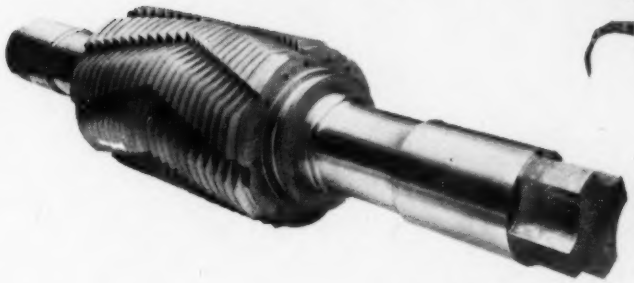


rough surface of the shell enlarged



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- coarse, rough texture gives excellent gripping of cane.
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Shaft:

- forged from high grade steel.
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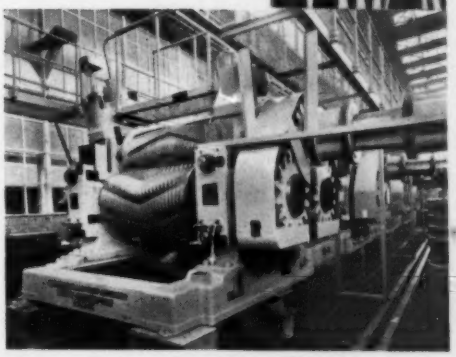
For excellent service and durability it will pay you to equip your mills with STORK-WERKSPOOR MILL ROLLERS.



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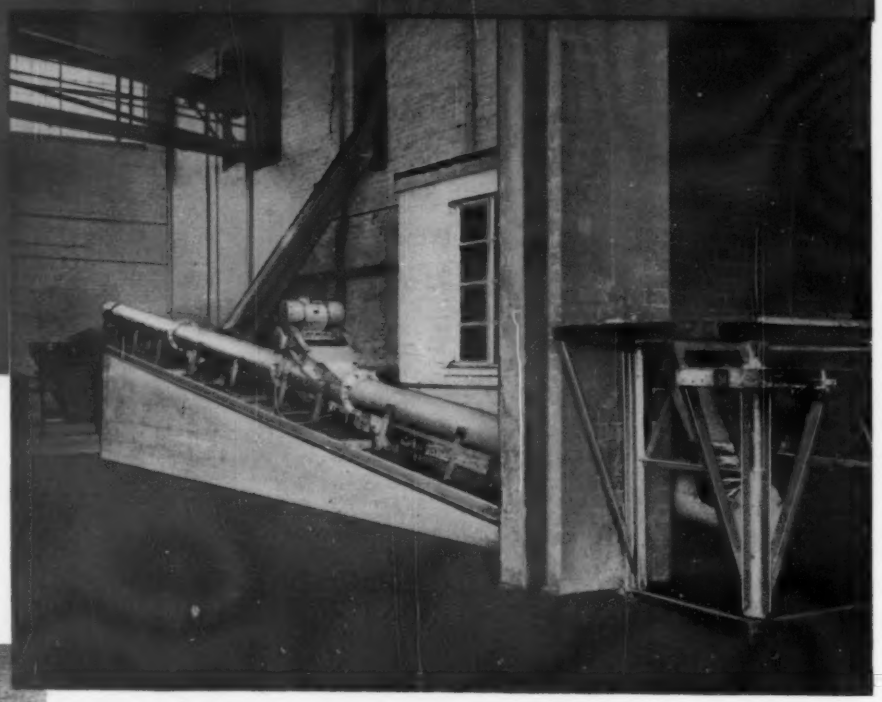
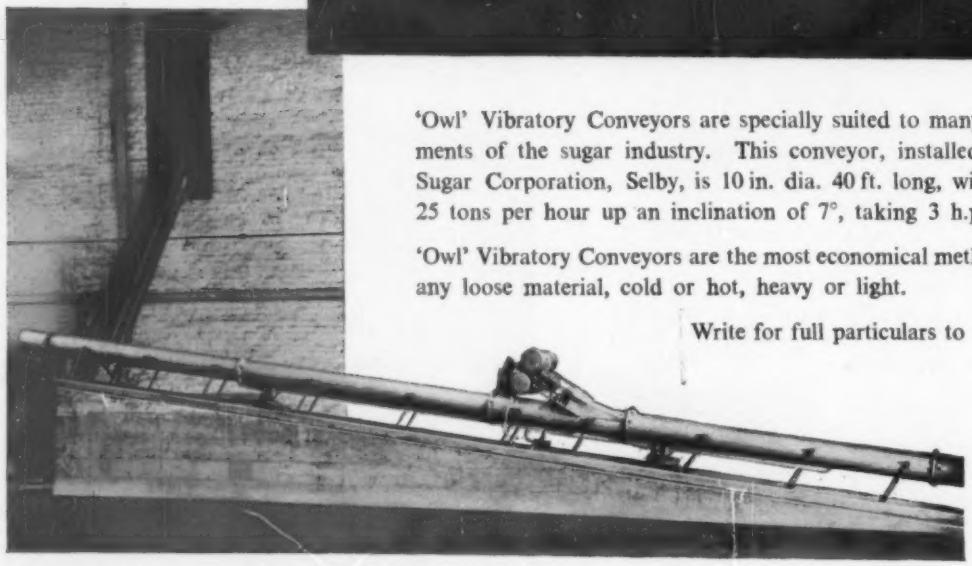
for the Sugar Industry





'Owl' Vibratory Conveyors are specially suited to many of the requirements of the sugar industry. This conveyor, installed at The British Sugar Corporation, Selby, is 10 in. dia. 40 ft. long, with a capacity of 25 tons per hour up an inclination of 7°, taking 3 h.p.

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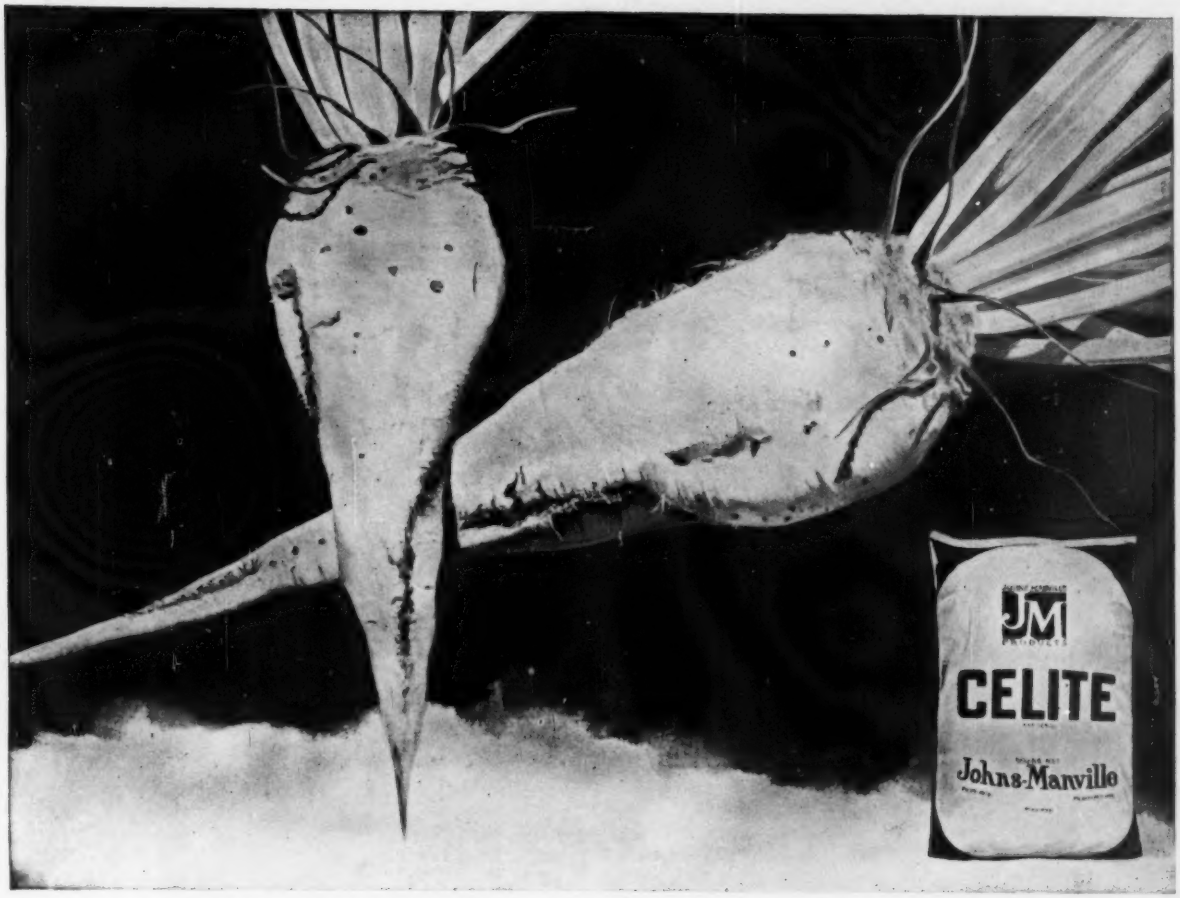

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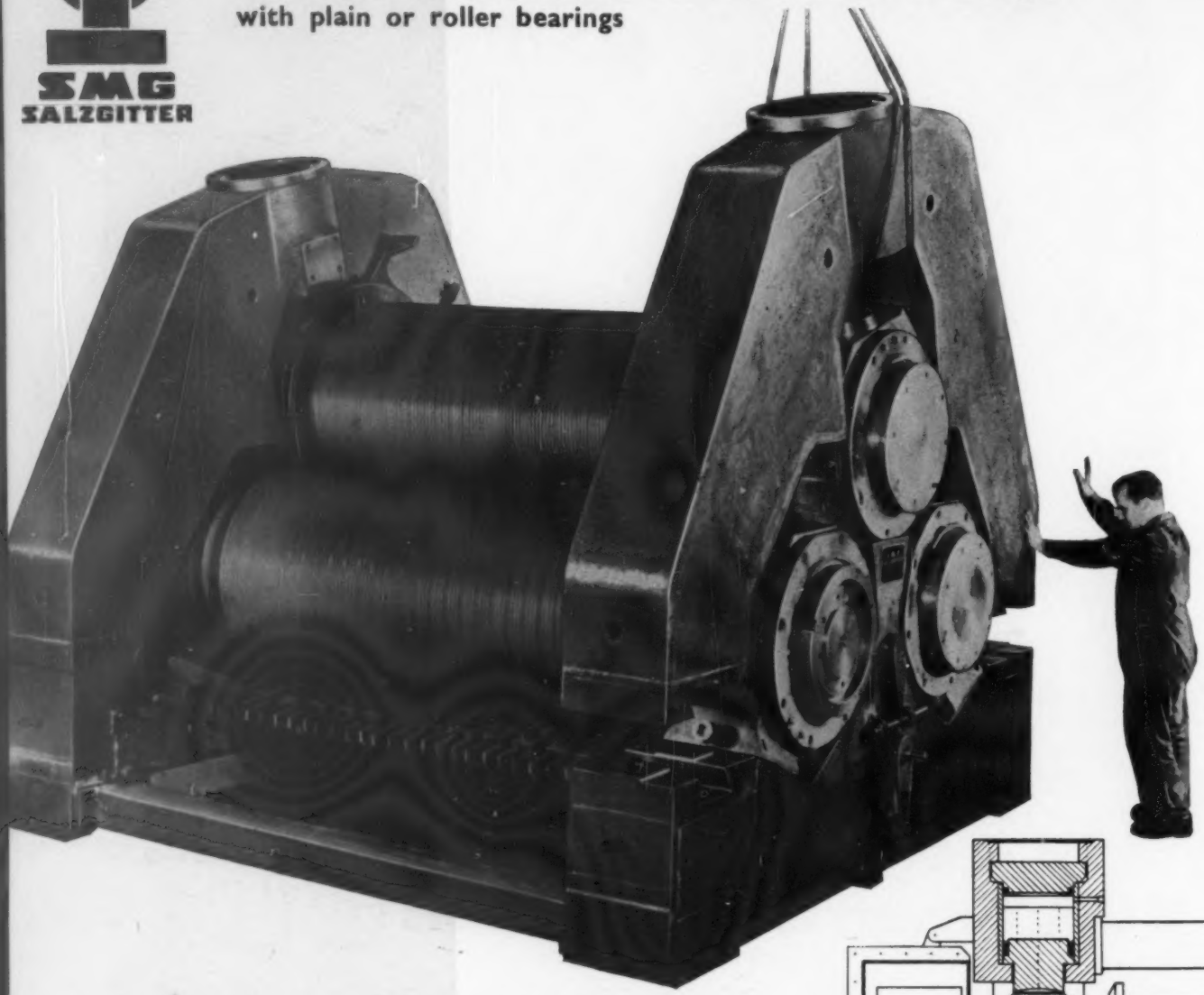

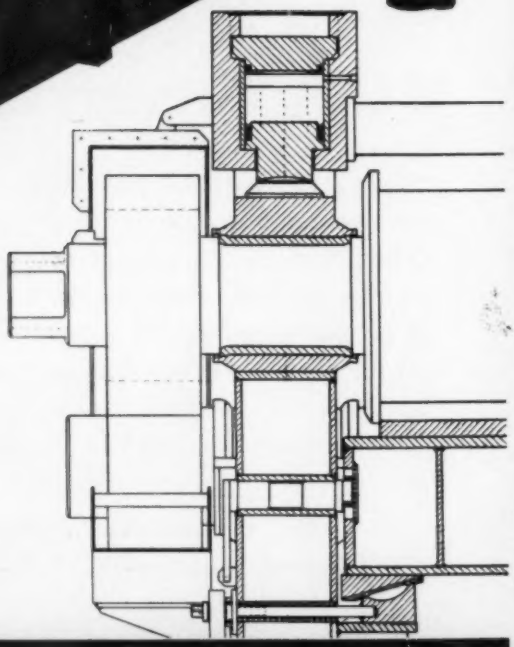

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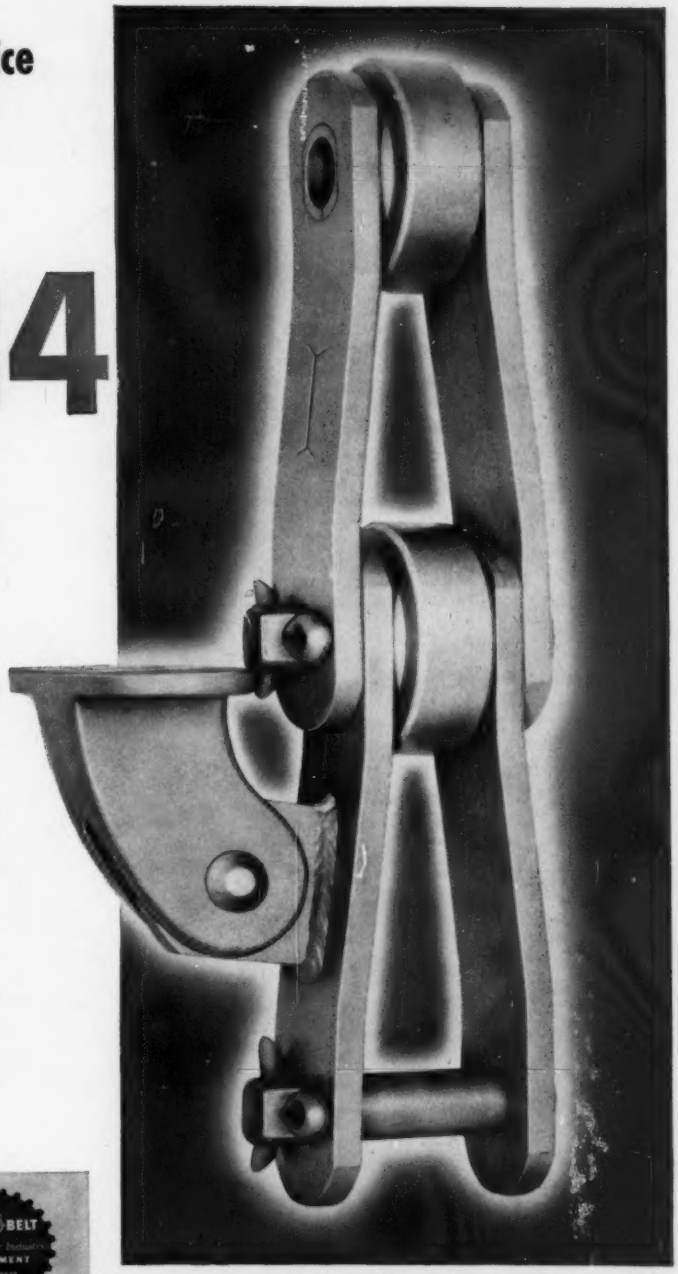

Exceptional strength and durability make Link-Belt SS-2184 Plus chain the choice for long, heavy-duty conveyors that reclaim and deliver bagasse to storage and boilers.

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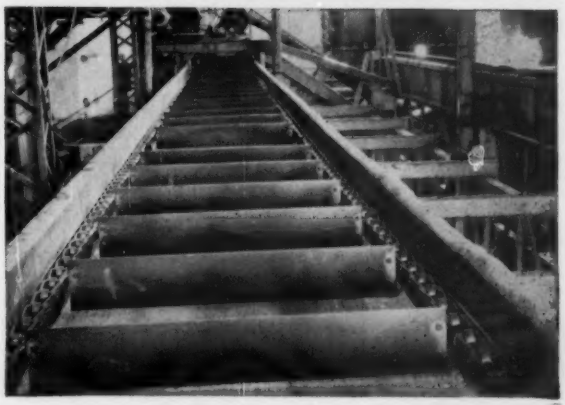

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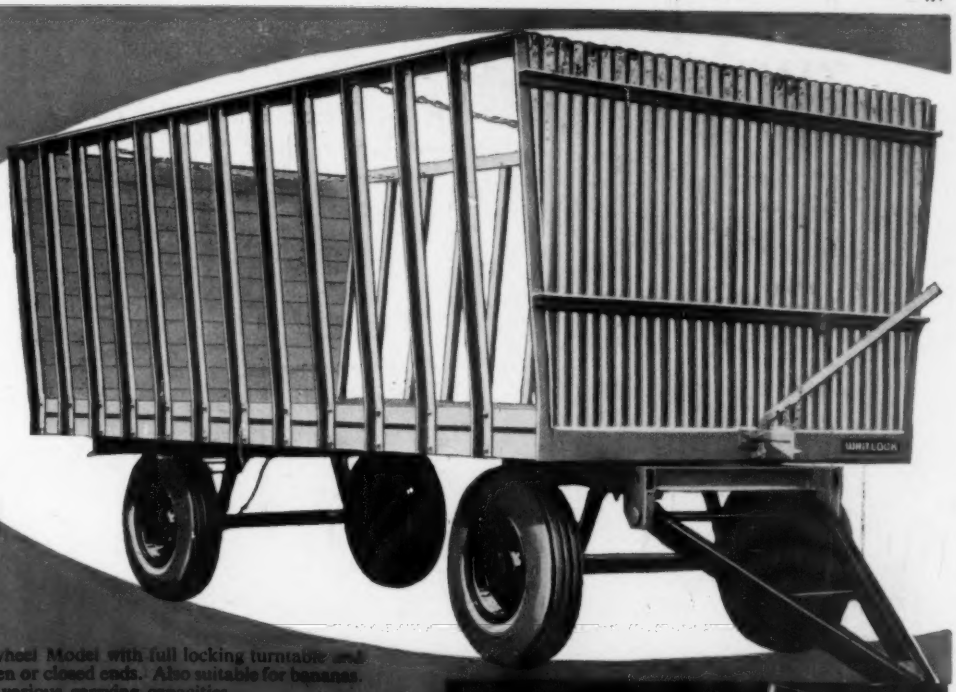

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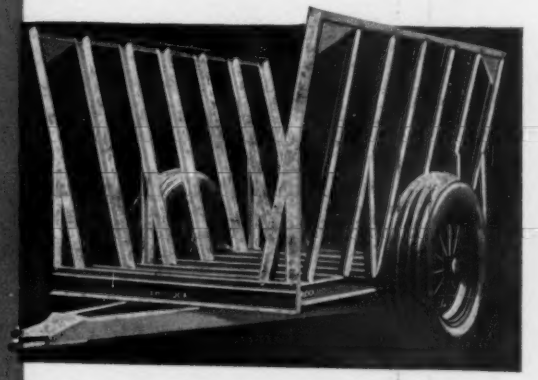

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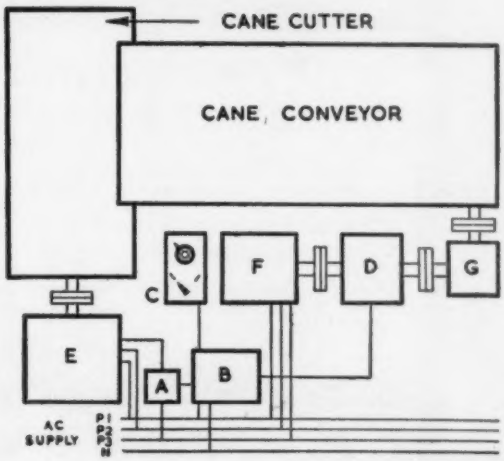
- **A** Current transformer
- **B** Electronic excitation unit
- **C** Manual control of conveyor speed
- **D** HEENAN-DYNAMATIC COUPLING in conveyor drive
- **E** Cutter motor
- **F** Conveyor motor
- **G** Gearbox



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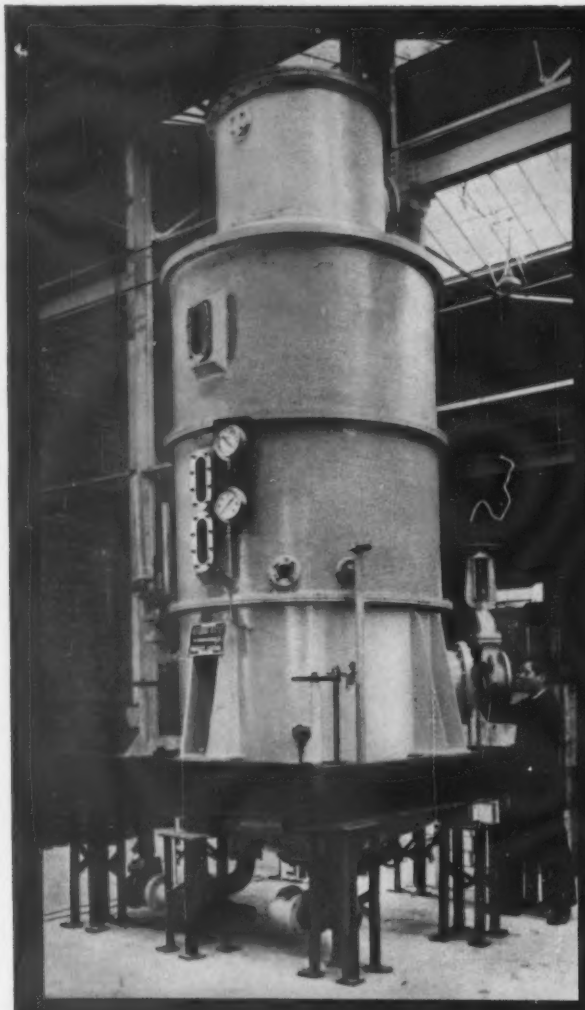

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXI NOVEMBER, 1959 No. 731

NOTES AND COMMENTS

European Beet Sugar Estimates.

Details have been published of F. O. Licht's first estimates of beet sugar production in European countries and appear on page 351 of this issue. C. Czarnikow Ltd.[1] comment: "Generally it had been anticipated that the overall total would be down on last year's by a considerable tonnage and so his forecast of 16,996,700 metric tons, raw value, compared with the revised figure for 1958/59 of 18,673,355 tons, did not come as too much of a shock. Nevertheless, 1·7 million tons was more than many observers were expecting and its immediate effect on the market was slightly bullish.

"It was well known that a belt of countries stretching from France in the west to Russia in the east had suffered severely from the drought this year and it is not surprising that the six countries in which Licht anticipates crop reductions in excess of ten per cent, namely France, Belgium, Holland, Denmark and West and East Germany, are all within that group. In Denmark the area sown has been substantially cut down, which accounts in part for that country's inclusion. Poland is only just outside and is shown with a reduction of almost ten per cent. Russian production is reckoned to be down by 380,000 tons but that country's outturn is so high these days that this represents a fall of only about six per cent on the 1958/59 estimate. The worst effects of the drought were mitigated in some districts of the U.S.S.R. by heavy rains in September, whilst an increase of 300,000 hectares in the area sown also helped to offset the poor climatic conditions.

"There has been no shortage of rain in the Balkans and all estimates are up on last season's figures by more than ten per cent. Similar increases are looked for in Sweden and the Irish Republic but so far as the former country is concerned this reflects a poor return in 1958/59 rather than anything outstanding about the current crop.

"In all other countries estimates are within ten per cent of last season's figures but the tendency generally within this group is downwards."

Sir J. L. Hulett & Sons, Limited, 1958/59 Report.

The production of the Group in the Union of South Africa for the 1958/59 season amounted to 387,166 tons. This is equivalent to 34·3% of the total Industrial production of 1,128,187 tons, and represents a record for the Group.

During the year the Company obtained freehold title to the mill sites at Amatikulu and Felixton after protracted negotiations with the Department of Lands.

The mills commenced crushing in the middle of April, 1958. Amatikulu closed down on the 14th February, 1959, followed by Felixton on the 1st March and Darnall on the 3rd March. The tonnages of cane crushed and the sugar produced by each mill were, in all cases, higher than in any previous year. The mills, in total, produced 304,243 tons of sugar from 2,811,243 tons of cane.

Arrangements for direct delivery of cane by road continue to operate satisfactorily. With the exception of sugars consigned to storage for export in the early part of 1959, all sugars for refining and for shipment overseas were consigned in bulk.

The tonnages of cane cut from the Company's Estates during the past season were the highest on record, amounting to 424,947 tons of cane harvested from 9,730 acres. The return per acre harvested showed an average yield of 43·7 tons of cane with an average sucrose content of this cane of 12·81%, equivalent to 5·6 tons sucrose per acre.

As a result of the record cane crop, Delville Estates Ltd., a wholly-owned Subsidiary, in keeping with the Parent Company's other interests in the Union of South Africa, had a successful trading year.

At 2nd September, 1959, Delville Estates Limited had a 40% Shareholding in Ngoye Paper Mills (Pty.) Limited which company experienced a good year. In spite of difficult trading conditions, sales within the Union were 1,817 tons higher than the previous year.

[1] *Sugar Review*, 1959, (426), 165.

Export sales, however, due mainly to severe competition from Scandinavian countries, fell away and showed a decrease of 2,012 tons as compared with 1958.

The Empangeni Mill, of Zululand Sugar Millers and Planters, Ltd., which commenced crushing on 5th May, 1958, closed its season on 14th February, 1959, with a record sugar production of 82,923 tons, from 755,865 tons of cane. A total of 855,816 tons of cane was available, and the excess of 99,951 tons was diverted to the Hulett Mills.

A major expansion scheme was embarked upon at the Empangeni Mill last year to provide additional milling capacity. The major portion of this scheme was completed during the off-crop period, which extended to 1st June, 1959, on which date crushing operations commenced for the 1959/60 Season. The scheme was originally estimated to cost £600,000, but due to extensions, and the provision of additional facilities, the total cost will probably be in excess of £710,000. The capacity of the Mill has been increased considerably as a result of the expansion scheme.

The Empangeni area suffered from the effects of a most severe drought during the year under review. The abnormal weather conditions experienced from April, 1958 to May, 1959 have seriously affected the Concession crop for the 1959/60 season, which is estimated at only 467,000 tons compared with 768,500 tons last year. Unfortunately, the cane-growing subsidiaries, Ukulu Properties Limited and Scotts Properties Limited, are amongst those most severely affected by the drought.

Taking into account cane to be received from Nkwaleni and diverted from Huletts, the sugar production of Empangeni for 1959/60 is estimated at only 73,500 tons from total cane supplies of 663,000 tons.

In conjunction with Corn Products Refining Company Inc. of America, a new Company, Refined Sugars & Syrups S.A. (Pty.) Limited was registered on 5th June, 1958. Refineries Investments (Pty.) Ltd., a Hulett subsidiary, has a 40% interest in the new Company, which also operates a wholly-owned subsidiary known as George Clark & Son South Africa (Pty.) Limited.

The new Company expects to commence the production of pre-packed Huletts Refined Sugar during August, 1959. Plans for the removal of George Clark's sugar processing factory from Pinetown to Rossburgh have been completed and the factory will be re-sited in the near future.

Hulett's South African Refineries Ltd. refinery at Rossburgh attained a record melt of 301,772 tons of raw sugar during last Season. The output of refined products from these raws totalled 285,305 tons, of which quantity 265,201 tons were marketed in the Union and 20,104 tons were exported to Malaya and East Africa.

With the introduction of the new carbonatation station which commenced operations on 4th March, 1959, Huletts refined sugars have now attained an exceptionally high standard.

Approximately £1,750,000 has been spent to date on the expansion of the refinery and the installation of bulk off-loading facilities.

During the year Triangle Limited manufactured 5,543 tons of sugar from 49,574 tons of cane, an increase of 882 tons of sugar on the preceding season. Resultant upon development during the past two years, the estimate for the 1959/60 season is 11,500 tons of sugar.

Since the acquisition of Triangle on 11th June, 1957, approximately 4,000 acres of land have been cleared, planted, and served by an overhead spray irrigation system. This constitutes the largest single area under this type of irrigation in the world. The mill's crushing capacity has been increased from 20 to 35 tons per hour by the addition of certain new plant which will later be utilised in the new mill when erected.

Construction of the Kyle Dam and canal commenced in September, 1958. Completion is scheduled for April, 1961. It is expected that the Company's allocation of water should be 60 cusecs during 1961, increasing to 120 cusecs during 1962, and to 160 cusecs during 1963.

The future development of both growing and milling activities is planned to coincide with the availability of water supplies. This will enable Triangle to increase its production progressively to upwards of 75,000 tons of sugar per annum by 1965.

Since the formation of Mhlume (Swaziland) Sugar Co. Ltd., on the 14th June, 1958, development has been satisfactory and most encouraging. During this time 7,500 acres of virgin bushlands have been cleared, of which 6,713 acres have been prepared and put under irrigation and 5,330 acres planted with cane.

A mill capable of producing upwards of 50,000 tons of sugar (the present quota being 40,000 tons) is nearing completion and it is hoped that trial crushing will commence towards the end of November of this year The official opening of the mill is scheduled to take place in March, 1960.

It is encouraging to note that a Sugar Advisory Board has been established to advise the Swaziland Government on sugar matters in the Territory. This should ensure the future of the newly established industry in Swaziland.

The ideal growing conditions of the 1957/58 and 1958/59 crop years have, unfortunately, not continued. As reported previously the crop in the Empangeni area has been seriously affected by drought, which has also affected the other cane supplies of the Company.

The Group's sugar production for the current season is presently estimated at 330,000 tons of sugar, a drop of nearly 15%. This is a serious decline, and will undoubtedly affect trading results.

QUALITY IN CANE AND BEET

THERE is a problem common to the cane and beet industries which is causing increasing concern; it is that of the association of a decreasing quality in the juice with that increasing gross yield of the crop, which has been so characteristic of recent years. In the cane industry Queensland offers one example of this association and the causes leading to it were discussed at the 24th Conference, Queensland Society of the Sugar Cane Technologists in 1957.[1] Here the primary cause appeared to be mainly varietal—the rapidly extending growth of Pindar, a cane of high yield but low juice quality, with over-burning as a contributory cause.

In the beet industry the same concern has been expressed and the causes discussed in two recent papers covering beet growth under very different climatic conditions—Belgium, where harvest takes place on a falling temperature, and California, where harvesting takes place at the hottest time of the year. In the former case the discussion is by M. SIMON and N. ROUSSEL under the title "How does Quality in Beet Occur?" (Comment Accroître la Richesse en Sucre des Betteraves Sucrières?) with the sub-title "The Factors Influencing Quality of Beets." (Les Facteurs qui Influencent la Richesse en Sucre des Betteraves.)[2]

In this paper the subject is discussed under five heads: varieties, stand, nitrogenous manures, disease and mode of harvesting. The varieties commonly grown are divided into 3 classes: normal, E varieties covering those giving high yield of beet, and polyploids.

The comparative results are collected in the following table :—

	Harvested early		*Harvested late*	
Type	*Sucrose* %	*Relative Economic Value mean=100*	*Sucrose* %	*Relative Economic Value mean=100*
E.....	15·86	99·6	16·60	99·6
N	16·33	97·7	17·01	97·8
Polyploid	16·27	105·8	17·19	105·8

The conclusion drawn is that the practice, now common, of growing a single variety is unsound.

Experimental evidence is quoted to the effect that a stand of 75,000/ha gives an increase of sugar % in juice over a stand of 60,000, which may amount to 0·05. A high stand is of particular importance in the case of the most productive varieties.

Excessive nitrogen, it is pointed out, leads only to increased yields of leaf and crowns with a depressive effect on juice quality in the root as shown in the following :—

		Relative Yields			
N kg/ha	*Sucrose* %	*Roots*	*Sugar*	*Leaves and Crowns*	*Gross Economic Value*
150	16·18	100	100	100	100
210	15·61	98·1	94·6	110·8	95·3

A maximum of 14 kg/ha before sowing is recommended but even this is subject to such factors as the nature of, and the importance of, restoring organic matter, weather during the growth period and soil fertility.

Two further causes of loss of quality in juice are mentioned; disease, where the reduction resulting from virus yellows may reach 1%, and harvesting methods. Recent tendencies have been in the direction of high topping, giving up to 10% increase in root weight but a decrease in juice quality varying in amount according to variety. Particular importance is attached to the point in the case of E varieties.

Californian experience is recorded by R. T. JOHNSON[3] and L. BURTCH.[4] The former points out that, while Californian tonnage has almost doubled in the last 25 years, this has been accompanied by a gradual decline in juice quality. Of dominant importance here is the nitrogen status of the plant. A revealing example is given of a survey of fields selected on the basis of sugar content :—

Class	*Average Sucrose Content* %	*Beets tons/ acre*	*Nitrate Nitrogen in Petioles*	*Nitrogen applied in 1958*	*Nitrogen applied past 4 years*
			p.p.m.	*lb/acre*	*lb/acre*
High	16·3	27·44	240	170	277
Medium	14·5	22·56	723	158	375
Low	12·5	25·04	2733	154	400

Significant here is the inverse relationship between sucrose content and N in petioles; less evident is that between sucrose content and amount of N applied. The important inference is the need for an adjustment of available N to the reduced demand as harvest approaches, which will ensure a juice of high quality. The difficulties inherent in designing such a fertilizer programme are discussed.

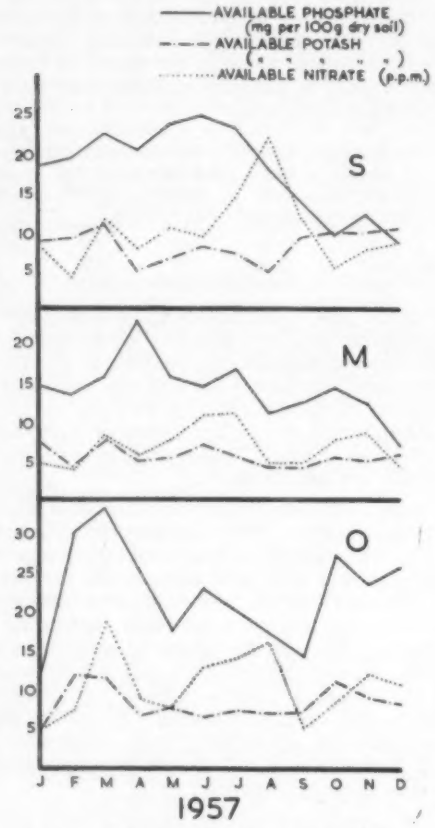
The latter author deals with the influence of weather, disease and varieties. The considerable influence of weather on juice quality is illustrated by a comparison between the 1957 and 1958 seasons. In part this is linked with the problem of N; surface accumulation of salt, including nitrate, takes place during the hot dry summer. Though the effects of weather cannot be eliminated entirely, there are cultural procedures which will minimize them and these are briefly discussed. In part, too, it is linked with disease which modern intensive cultivation, with consequent increased incorporation of disease-bearing residues in the soil, tends to stimulate.

On the question of variety, an analysis of a large number of trials under a wide range of conditions, in which yields ranged from 9 to 38 tons per acre, indicate that, by varietal selection, sucrose content may be raised somewhat less than 2·5%.

In both beet and sugar cane, the importance of the N factor figures largely. For tonnage, ample supplies of N are required during the period of active growth; for high sucrose content a pre-harvest diminution of

[1] *I.S.J.*, 1958, **60**, 123.
[2] *Pub. Vulg. Inst. Belge pour l'Amél. Bett.*, 1958, (1&2), 17 pp.
[3] *Spreckels Sugar Beet Bull.*, 1959, **23**, 6.
[4] *Spreckels Sugar Beet Bull.*, 1959, **23**, 13.

the N supply is required. Regulation of the N supply becomes a matter of high importance. In this matter the cane grower holds an advantage; the prolonged growing period, extending to, perhaps, 2 years, enables nitrogen dressings to be applied during the period of growth and he has at his disposal foliar or other tissue diagnosis on which to determine the amount and the time of application. With the relatively short growing season for beet, such applications are rarely possible; foliar diagnosis can help little and rapid methods for soil analysis do not exist. Much depends on a correct evaluation of the pre-drilling N application, and here enters a further aspect which has hitherto rarely been taken into consideration.



MONTHLY SOIL ANALYSES, 1957.

S = Stockless section (Green fallow; fertilizer applied April 1957)

M = Mixed section (Crop: 2nd year ley—grazed; Nitro-Chalk applied March 1957)

O = Organic section (Crop: 2nd year ley—grazed).

The extent of the seasonal variations in the supply of nutrients in available form has never been widely appreciated. Yet they are very great and not confined to N. Cultural methods, too, produce some remarkable, rather unexpected, and sometimes cumulative changes.

Some indication of these changes is given in the attached graph[5] derived from the "Haughley Experiment", an historical account of which appeared in the Journal of the Soil Association.[6] The changes due both to season and cultural systems are evident, and the marked variations, which cannot be discussed here, become apparent when this diagram is compared with the corresponding diagrams for the respective seasons 1953–1956.[7] Similar seasonal changes in the N status of the soils of the Gangetic plains were observed long ago by G. CLARKE[8] and, no doubt, occur universally. They are of a magnitude which should enter into the calculations of any fertilizer programme.

H.M.-L.

Varieties of Sugar Beets. ANON. *Farmers' Leaflet* (National Institute of Agricultural Botany), 1958, (5), 4 pp.—Brief descriptions and characteristics of ten recommended and six provisionally recommended varieties of sugar beet are given.

* * *

A Preliminary Report on Research and Experiments on Sugar Cane Varieties and Cultural Practices in the Pearl River Delta. Y. C. CHEN. *Acta agric. sin.*, 1958, **9**, 182–191; through *Hort. Abs.*, 1959, **29**, 358.—Yields in cultural experiments were increased by deeper planting and earthing-up, by earlier planting and by interplanting with early soya beans. A rotation of two years' cane followed by one year each of jute and sweet potatoes was better than continuous cane cropping. In variety trials POJ 3016 and F 134 were superior to POJ 2878.

* * *

The Nitrogen Requirement of Sugar Cane in Mysore. K. L. BHATTA and B. T. NARAYANAN. *Ind. J. Agric. Sci.*, 1958, **27**, 427–444.—Trials on three stations indicated a high nitrogen requirement varying from 300 lb to 400–450 lb per acre. At least half the N should be in inorganic form. It is recommended that a basal dressing of green manure or compost equal to 100 lb N per acre to be followed by oil cake or ammonium sulphate in equal proportions to make up the balance, be used. Applications in excess of 500 lb N per acre tended to depress sugar content.

* * *

Solubilization of Phosphate Rock by Composting with Peat. R. CAROLAN. *J. Sci. Food Agric.*, 1959, **10**, 207-209.—Experiments in Ireland with Algerian phosphate rock showed almost 5-fold increase in citric acid-soluble P_2O_5 in a 6 : 1 mixture peat : rock and an 8-fold increase in a 10 : 1 mixture with a decrease in acidity due to the $CaCO_3$. The results are in accord with those obtained in Germany, U.S.A. and Finland. The phosphate rock also supplies calcium, magnesium, sulphur and, possibly, trace elements.

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[5] *Mother Earth*, 1959, **10**, 433.
[6] *Mother Earth*, 1956, **9**, 660–663.
[7] *Mother Earth*, 1955, **8**, 141; 1956, **9**, 399, 692.
[8] *I.S.J.*, 1948, **50**, 202.

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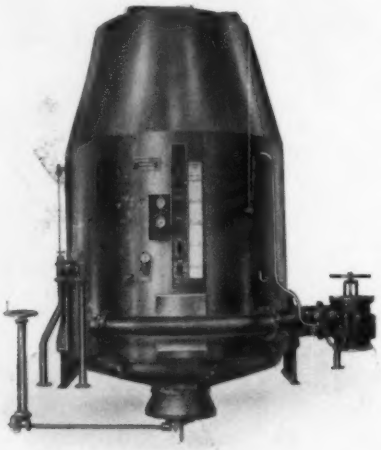

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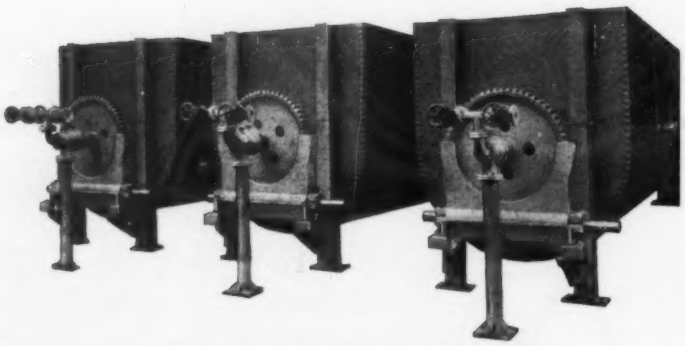

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SUGAR CANE BREEDING IN BARBADOS

TWENTY-FOURTH ANNUAL REPORT, BRITISH WEST INDIES CENTRAL SUGAR CANE STATION, BARBADOS, 1957.

THE year saw the celebration of the Silver Jubilee of the Station. In the previous 25 years a varietal revolution has taken place throughout the contributing territories leading to greatly improved yields. Varieties of Barbados origin, too, have spread to all the major cane growing areas of the world.

The Hawaiian technique of using a preservative solution in which to grow cut arrows for breeding had not proved successful in earlier trials in Barbados and the method had been discontinued. Opportunity to study the method during a visit of the Senior Geneticist to Hawaii suggested certain modifications which have been tried out with success. They include increase in the volume of preservative liquid, better protection of the metal containers from the action of the acid and the replacement by rain water of the normally alkaline tap water used.

The inbreeding programme has been continued and is discussed in some detail. In many of the lines the major morphological characters have become fixed. Arrowing in the inbreds is a complex phenomenon and appears to be polygenic, though influenced by environmental conditions. The occurrence of only a few male-sterile derivatives after 3–4 selfings suggests that male-fertility, essential for inbreeding, is genetically controlled.

These inbreeding trials have been extended to include juice studies which are proving of considerable interest. In certain inter-generic crosses, both nobilizations and those having a *spontaneum-robustum* origin, all derivatives have shown low juice quality; in certain others the juice quality has been uniformly high and the value of these for breeding is also potentially high. In particular, derivatives of two lines from B 4362, which reverted to a *spontaneum* habit, had juice of exceptional quality combined with great vigour and their potential value as parents is being tested. The different points of view taken in Hawaii[1] and by T. S. RAGHAVAN[2], as to the value of inbreeding, are briefly reviewed, but some years must pass before this value as a means of securing commercial varieties is definitely established.

CYTOLOGY

Cytological studies have been continued and refinements in technique are described. Chromosome studies covering the inbred lines from inter-specific crosses show chromosome losses in varying degrees, being lowest in those lines in which fixation of characters occurs early. The *spontaneum* selfs of B 4362 noted above show meiosis to be regular and the suggestion is made that viability of gametes occurs only with one gene array and the facts of a heavy pollen-shed and a low seedling population per arrow are quoted in support.

COLLATERAL INVESTIGATIONS

X-ray irradiation of dry fuzz up to dosages of 1,000r produced no mutational changes in B 41211. Gibberellic acid, tested as a potential stimulant to arrowing, had no significant effect on the plant at that age, affecting neither arrowing nor vigour of growth. From commercial fields, cases are reported of intensified arrowing in cane from setts subjected to hot water treatment.

A problem of local significance, due to the high lime content of irrigation water, is a chlorosis affecting certain varieties and appearing to have a genetic basis. It becomes important in seedling work and has been overcome by using soil, sand and weathered filter-press mud for seedling propagation.

BREEDING AND SELECTION OF COMMERCIAL VARIETIES

Seedlings of the B 59 series potted numbered over 31,000 with nearly 7,500 planted in bunches. Tabulated statements, containing considerable detail and covering the field trials up to the B 54 series, are given, but in too detailed form to be discussed here. A summary describes five of the later varieties surviving in the race for the commercial variety stakes; they are B 5213, B 52107, B 52144, B 52298 and B 53200.

VARIETAL PERFORMANCE

In British Guiana B 37161, at 43% of the acreage, and B 41227, at 32%, dominate the crop with B 4098, at 5·3%, a bad third. B 47258, newly introduced, is likely to gain in popularity.

Antigua is dominated, at 93·1% of the area, by B 4098 but B 49119 and, to a lesser extent, B 4744 are likely to be planted on a very large scale in the near future.

In St. Kitts B 37161 and B 41221 share 86·6% of the crop but the present small lead of the former is being reduced by the latter.

B 37161 still leads in Barbados, but the area under it has fallen from 54·5% in 1957 to 38% while the plant cane area has fallen to 14·6%. Increased planting of B 41211, B 4744, and B 49119 are recorded.

The acreage figures in Jamaica have little significance owing to selective varietal distribution to meet ecological conditions. Of the less selective varieties, B 41227 at 29% of total acreage and B 4362, at 21%, show slight increases. The same holds good to a certain extent in Trinidad where the position remains stationary with B 3337, at 29·4%, B 37172, at 25·9%, and B 37161, at 23·7%, as the leading varieties.

H.M.-L.

[1] *Hawaiian Planters' Record*, 1953, **54**, 139; *I.S.J.*, 1953, **55**, 328.
[2] *World Crops*, 1957, **9**, (6); *I.S.J.*, 1957, **59**, 7.

SUGAR CANE AGRICULTURE IN TAIWAN

REPORT OF THE TAIWAN SUGAR EXPERIMENT STATION, No. 17, OCTOBER 1958

FOLLOWING previous practice, the Report consists of a series of papers. The first, by K. H. TANG and F. W. HO, describes eight experiments, at six locations and covering clays and loams, in which a single operation of sub-soiling to a depth of 18 in was performed, either before planting the cane or the preceding green manure crop. In no case was a significant difference in yield obtained. The standardization of the operation, particularly as regards depth, is unfortunate, for the objective in sub-soiling is to shatter the hard-pan which interferes with drainage and root penetration. Hard-pans arise as a result of numerous factors, chemical and physical, which enter into the reactions of the soil. Their intensity and the depth at which they occur, and even whether they occur at all, depends in large measure on the character of the soil itself as well as on the climate.

Among the practices adopted in Taiwan is planting cane in the paddy fields. Several methods are adopted and these are described by H. C. FU, who adds to previous methods one evolved by himself which is particularly adapted for use in autumn-sown paddy. Earlier methods have aimed at adjusting planting conditions to moisture requirements through a combination of ridging and draining, often involving considerable labour. In the new method, two-budded setts are inserted at an angle with the lower bud below surface level. On harvesting the rice, the sett is pressed home with the upper bud just above the surface. The best results were obtained when the upper buds remained above water-level, but complete germination was obtained when only the cut upper end was exposed to air and even when the sett was immersed up to three days.

A not too laborious technique for estimating the percentage infection by ratoon stunting disease is described by H.T. CHU, S. M. LIEE and C. Y. LIEE. The results obtained from slides exposed at different levels in fields of N:Co 310 by H. T. CHU and T. K. TSAI indicate that the spores of leaf scorch, *Stagonospora sacchari*, are wind-borne.

Taiwan experience in raising and releasing the Cuban fly, *Lixophaga diatraeae*, in 1955 is recorded by C. B. CHEN and T. H. HUNG. Artificial rearing has been simplified by the discovery that larvae of the "grain moth" provide suitable hosts, while present evidence suggests that the fly will parasitize both the borers, *Proceras venosatus* and *Chilotraea infuscatella*. Normal temperatures and the fact that cane is present in the fields at all seasons, suggest that the fly will become permanently established.

To this report may be added the study of cane transportation costs in Taiwan published separately[1]. The cane, from which some 900,000 tons sugar are extracted annually, is all brought to the factory on narrow gauge railways. The economic problem, therefore, concerns transport from the field to the railway. Comparisons are drawn between several systems of loading 5-ton trailers and the subsequent conveyance of these by oxen or crawler-tractor. Piling into half-ton heaps as cut and lifting these into trailers by a mobile crane appears to be the most economic procedure. For hauling the trailers to rail, oxen are, under present conditions, preferable to tractors.

H. M.-L.

[1] *Taiwan Sugar*, 1959, **6**, (1), 13–18.

AGRICULTURAL ABSTRACTS

Sugar Cane Smut. R. A. ROBINSON. *East African Agric. J.*, 1959, **24**, 240–243.—An account is given of sugar cane smut (*Ustilago scitaminea* Syd.) in Kenya, which was first officially diagnosed only in 1958, although suspected in 1956. This distinctive and easily recognised disease, with the central shoot of the cane transferred into a long, whip-like structure is one of the more serious diseases of sugar cane and its presence is viewed with some alarm in Kenya. It is believed to have been brought into Kenya by some human agency such as unauthorised importation of cane setts for planting or diseased cane material used in packing. So far the disease is known to occur in five localities in Nyanza and one locality in Coast Province. As sugar cane varieties differ greatly in susceptibility to smut the use of resistant varieties in affected areas may help to reduce losses. A list of varieties is given with remarks on susceptibility.

* * *

Importance of Mosaic in Present Commercial Varieties of Sugar Cane in Louisiana. E. V. ABBOTT. *Sugar Bull.*, 1959, **37**, 179–181.—Two reasons are offered for the re-occurrence of mosaic as a factor of importance: the release of susceptible varieties and the appearance of a new strain of the virus. Renewed attention requires to be devoted to such matters as rogueing and planting of resistant varieties. Of the three varieties widely planted, N : Co 310 appears the more tolerant with a yield reduction in three seasons (two plant and one ratoon) of 14·3%, the corresponding figures for CP 44–101 being 28·8 and, for CP 52–68, 33·0%.

"Endrin" for Sugar Cane Borer Control. L. D. NEWSOM. *Sugar Bull.*, 1959, **37,** 214–220.—Of the many new insecticides introduced in recent years "Endrin" has proved most promising. Its future use, regarded from the point of view of the prospects of its effect on hyper-parasites of the borer and of the development of resistance in the borer population, is discussed in considerable detail.

* * *

The Variety Cuba 693-47. A. L. FORS. *Bol. Ofic. A.T.A.C.*, 1959, **18,** 95–99.—Cuba has not been prolific in raising new commercial varieties. A description is given of the above cane, derived from a cross POJ 2878 × a Cuban variety C 15792 made in 1947, which is proving itself superior to other commercial varieties. Descriptions are given both of its vegetative and agricultural characteristics.

* * *

Fool-Proofing Cane and Sugar Production with Research. W. E. CROSS. *Sugar J.* (La.), 1959, **22,** (10), 7–12.—The author recounts his experiences and successes in solving many of the problems which have provided head-aches to the cane grower. These range from weed control, through disposal of distillery wastes, to minimizing sugar losses from delays between cutting and crushing and from the inclusion of excessive trash.

* * *

Land Forming Improves Field Drainage. CATERPILLAR TRACTOR CO. *Sugar J.* (La.), 1959, **22,** (10), 19–21.—Even apparently level fields will show depressions after rain. The principles of soil moving in such cases, as well as in comprehensive schemes such as may involve contouring, are laid down.

* * *

Fire Ant Control: Effects on the Sugar Cane Borer. E. A. CANCIENNE. *Sugar J.* (La), 1959, **22,** (11), 17.—In a paper presented to the American Society of Sugar Cane Technologists it is reported that broadcasting 10% granulated "Heptachlor" at 20 lb per acre to control the introduced fire ant which has become established in Louisiana over the last 15 years, has led to a large increase in borer damage. "Endrin" is suggested as a substitute.

* * *

Cane Borer Control in Louisiana. W. H. LONG *et al. Sugar J.* (La.),1959, **22,** (11), 24, 25.—An account is given of the substances progressively used for the chemical control of the borer, culminating in "Ryania" dust and granulated "Endrin". Evidence to date indicates no adverse effect from the latter on *Trichogramma* population.

Sugar Cane Breeding and Selection. R. D. BREAUX *et al. Sugar J.* (La.), 1959, **22,** (11), 21–23.—In a paper presented to the American Society of Sugar Cane Technologists the methods employed at the Louisiana State University are detailed.

* * *

Cultivation of Sugar Cane in the Deccan. R. S. JAMASJI. *Indian Sugar*, 1959, **8,** 667–672.—A general picture is given of the cultural methods adopted in the Deccan.

* * *

Sugar Cane in Kenya. ANON. *Kenya Dept. Agric. Ann. Rpt.*, 1958, 33.—In Nyanza Province variety trials showed B 41227 to be the most satisfactory variety under irrigation; B 41211 also did well. Under rain fed conditions B 37193 proved very satisfactory, as did N : Co 339 in another trial. Gypsum and soil ripping treatments gave good results on poor soils with impeded drainage. In fertilizer trials on ratoon cane sulphate of ammonia applied in the Short Rains (150 lb) under trash gave the greatest increase in yield. Deep planting of cane, under dry conditions at Kakamega, proved beneficial.

* * *

The Use of Paratheresia claripalpis for biological control of Diatraea saccharalis, with special reference to the results obtained in the valleys of Pativilca and Huaura. S. H. RISCO. *Rev. Peru Ent. agric.* 1958, **1,** 24–29 ; through *Hort. Abstr.*, 1959, **29,** 360.—Liberation of the parasite *Paratheresia claripalpis* in sugar plantations reduced infestation by the borer *Diatraea saccharalis* in the first locality by over 55% in 4 years and in the second by 84% in only 3 months.

* * *

Effect of spacing-cum-nitrogen application on the yield of sugar cane in Malnad tract. S. V. PATEL, M. B. TIPPANNAVAR and M. V. KULKARNI. *Mysore Agric. J.*, 1958, **33,** 66–70.—In a 3-year experiment 225 lb of nitrogen per acre increased yield by 5–10 tons over that obtained from 150 lb N per acre. With low average yields a two foot spacing was desirable but with higher yields (35 to 55 tons) a three foot spacing was preferable and better suited for bullock drawn cultivation implements.

* * *

Effect of cold on sugar beet tissues. J. FOURRÉ. *Compt. Rend. Acad. Sci. Paris.* 1958, **247,** 338–9; through *Field Crop Abs.*, 1959, **12,** 125.—The results from cytological observations on sugar beets kept at temperatures between 0° and —16°C showed that the various tissues of a single root have different resistances to low temperatures.

STARCH IN CANE JUICE CLARIFICATION

By M. C. BENNETT and N. O. SCHMIDT

Department of Sugar Chemistry and Technology, Imperial College of Tropical Agriculture, Trinidad, W.1.

PART II

Starch as a Flocculant

The effects of starch on clarification behaviour have been described in Part I where it is shown that starch is most effective as a flocculant when added as a viscous solution to the juice after liming and boiling. The mechanism of this flocculation is discussed below.

From studies on coaldust slurries[18,19] and mineral phosphate slimes[18] it has been concluded that the activity of starch as a flocculant must be attributed to the highly-branched amylopectin fraction which, in most starches, represents between 70 and 80% of the starch. It has been found that active starches contain an appreciable quantity of phosphate, and this too is associated with the amylopectin fraction generally occurring as the ester near an intersection of two branches. It has been suggested that flocculation of a particle system is brought about by direct mechanical crosslinking through these phosphate centres.

In this section it will be shown that the activity of a starch is dependent not only upon properties of the starch (amylopectin) molecule itself, for example, upon the esterified phosphate content, but also upon properties of the viscous aqueous solution from which the starch is added, for example, upon starch concentration. These latter properties determine the size of molecular aggregates which will be added to the juice system and it is evident that the interaction between starch and preformed defecation flocs takes place before the added starch reaches equilibrium with its new environment.

Experimental

The activities of various starch solutions were compared by determining the sedimentation rate of flocculated material in samples of limed and boiled juice to which a constant quantity (say 50 p.p.m.) of starch had been added. The ratio between the observed rate (V cm/min) and rate in absence of starch (V_0 cm/min) provides a measure of activity of each starch solution.

The preparation of the juice, the defecation process used and the measurement of sedimentation rate (i.e. the constant initial settling rate, V) have been described in Part I and in a previous paper[18].

The total phosphate content of the various starches was determined on samples ashed in presence of P-free magnesium nitrate; phosphate determinations were made by a molybdenum blue colorimetric method using phenylhydrazine sulphate as a reducing agent[20]. Admixed inorganic phosphate was separated by dissolving a known quantity of starch in water, precipitating the starch in 70% alcohol and centrifuging. Any inorganic phosphate remained in the aqueous alcohol and was determined after removal of the alcohol and concentration of the aqueous solution.

Starch moisture contents were determined by drying starch samples to constant weight in a vacuum oven at 70°C. Starches used here had moisture contents around 15% and individual figures are given in the relevant section below.

Apparent viscosities were determined using a Brookfield rotating cylinder viscometer where the applied shear could be varied by changing both the cylinder dimensions and the angular velocity. A series of viscosity measurements at different shears was made on each starch solution and the true (residual) viscosity determined by extrapolation to zero reciprocal shear after the method of Goodeve and Whitfield[21].

The salts used were of analytical reagent grade.

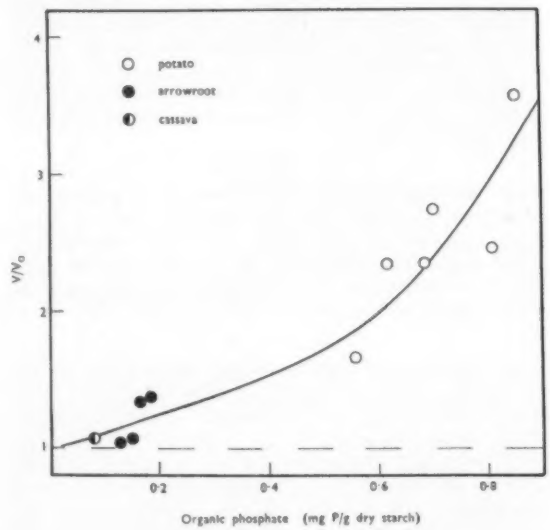

Fig. 5.

The relation between activity and organic phosphate content of different starches. Activity measured at 50 p.p.m. starch in the juice, added from starch solutions containing 7 g/litre with no electrolyte.

[18] Samuel: *Chem. and Ind.*, 1936, **55**, 669.
[19] Tomalin: *J. Soc. Chem. Ind.*, (*Transactions*), 1937, **56**, 384.
[20] Williams: *Proc. B.W.I. Sugar Tech.* 1954, 167; *I.S.J.*, 1957, **59**, 225.
[21] *Trans. Faraday Soc.* 1938, **34**, 511.

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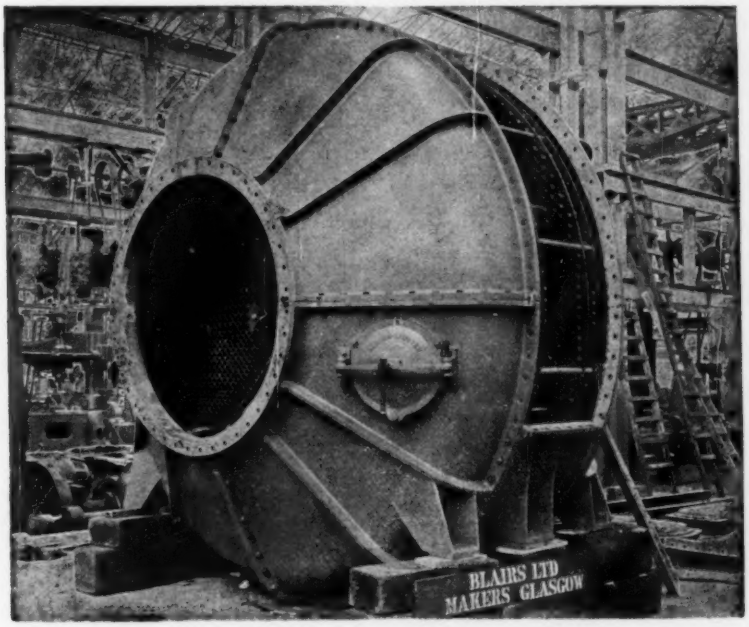

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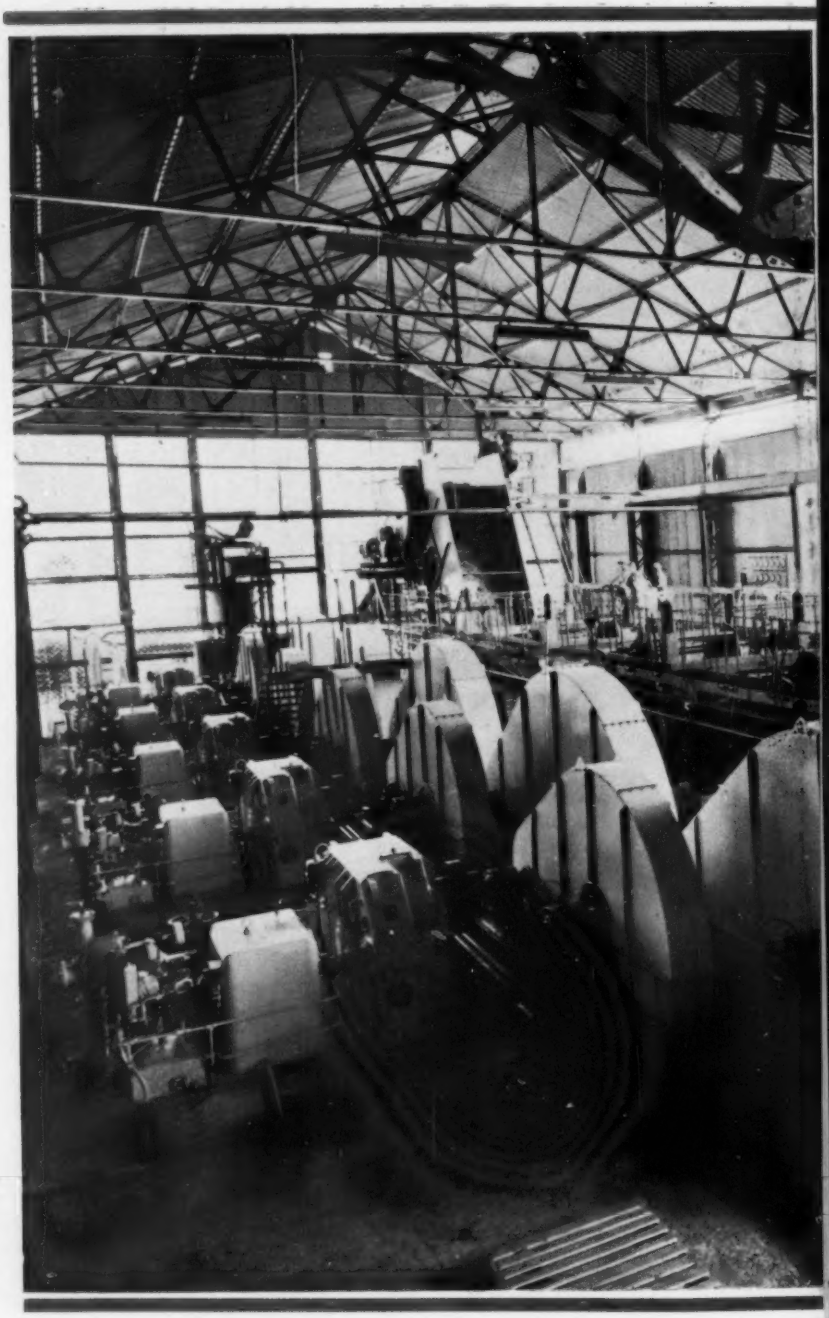

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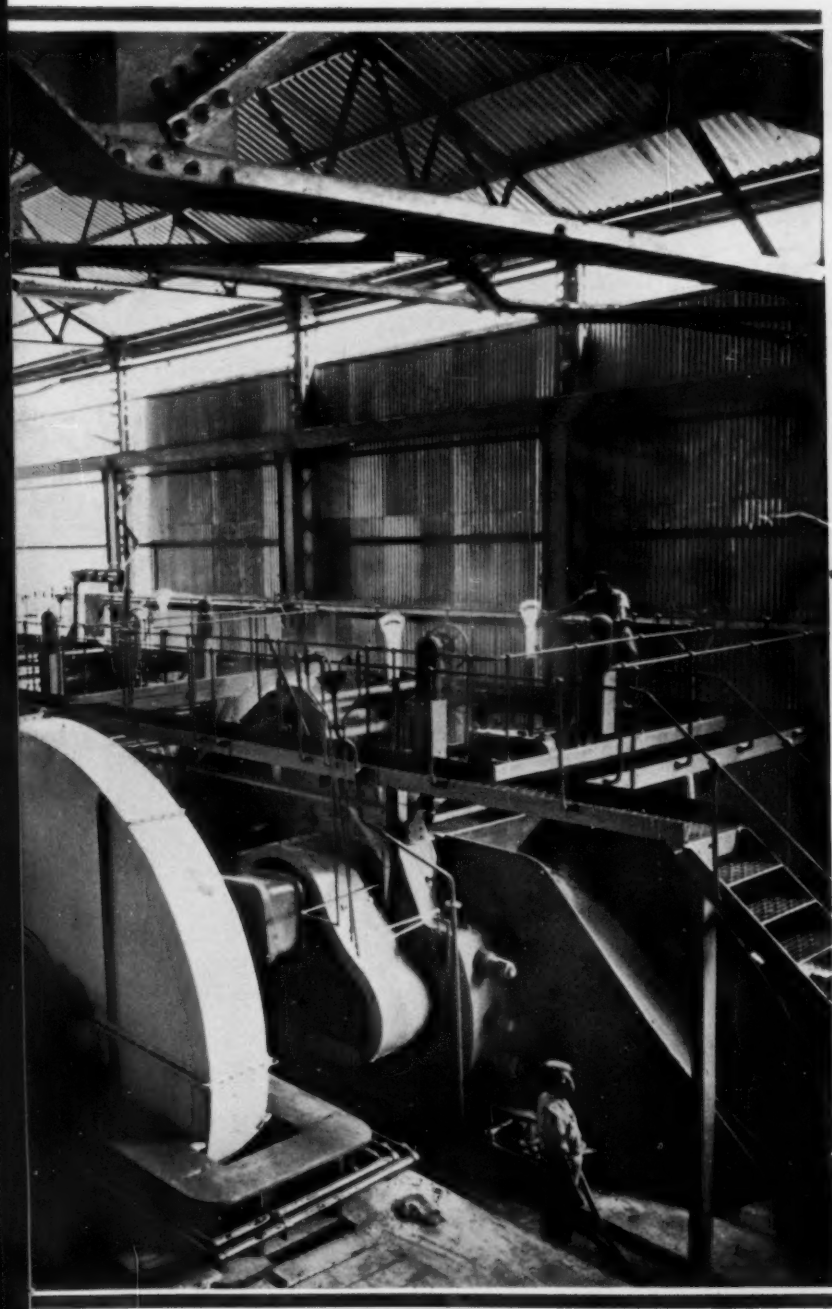

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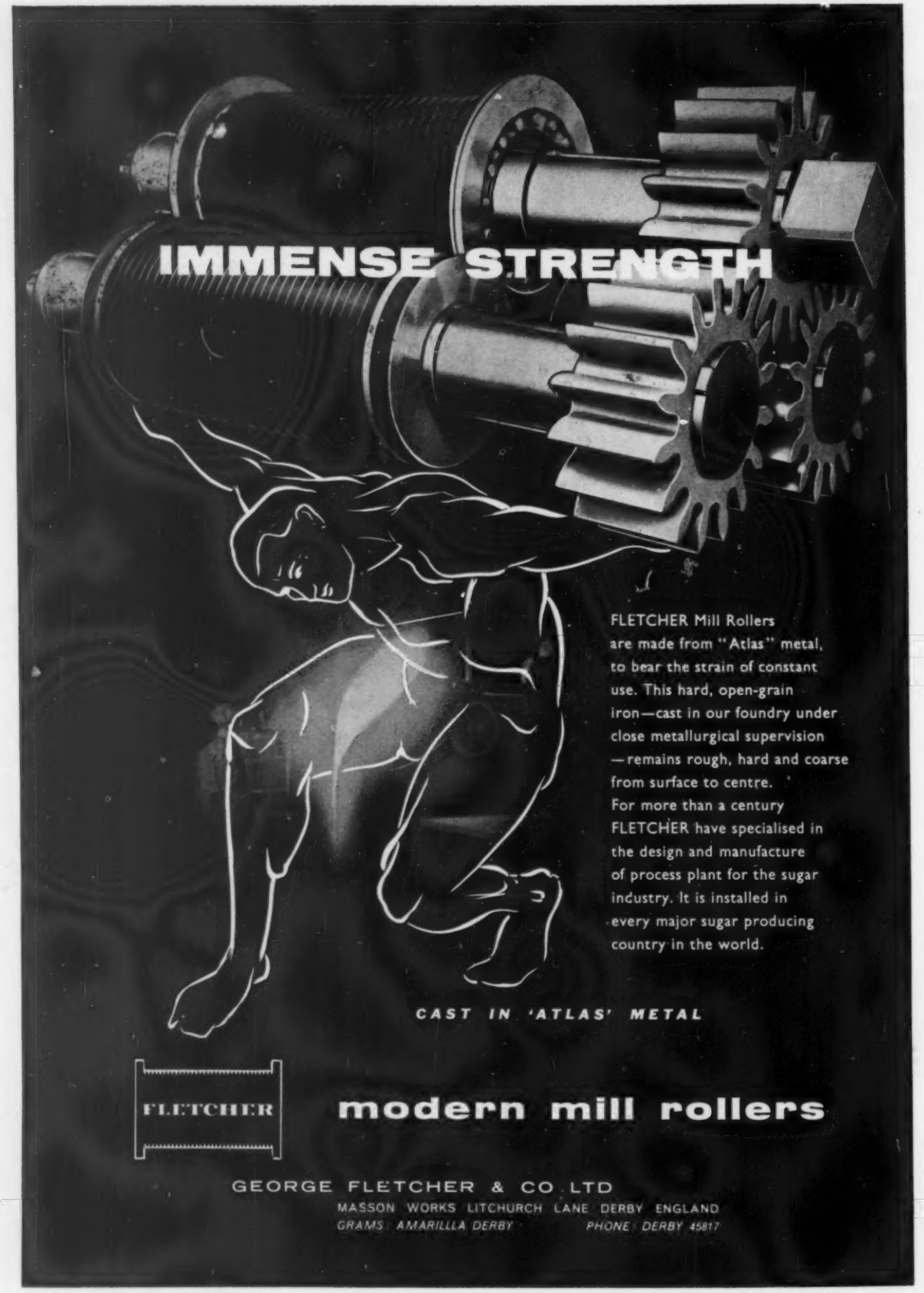
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Results and Discussion

(*i*) *Properties of the Starch.*

The phosphate analyses of six potato starches, four arrowroot starches and one cassava starch are shown in Table VI; the activity of each starch (at 50 p.p.m. in the juice) is plotted against organic phosphate content in Figure 5.

Table VI. Starch analyses (P-contents on dry starch basis)

Starch	*Moisture* %	*Total P* mg/g starch	*Organic P* mg/g starch
Potato 1	15·8 ..	0·94 ..	0·81
Potato 2	16·8 ..	0·91 ..	0·85
Potato 3	16·0 ..	0·83 ..	0·56
Potato 4	15·5 ..	0·71 ..	0·62
Potato 5	15·0 ..	0·71 ..	0·69
Potato 6	17·0 ..	0·70 ..	0·70
Arrowroot 1..	13·3 ..	0·21 ..	0·17
Arrowroot 2..	13·6 ..	0·20 ..	0·18
Arrowroot 3..	12·9 ..	0·18 ..	0·13
Arrowroot 4..	13·3 ..	0·15 ..	0·15
Cassava	14·5 ..	0·10 ..	0·08

It is to be noted that the *total* phosphate content of the least active potato starch (No. 3) is considerably greater than that of more active starches (Nos. 4, 5 and 6); this particular sample had been in store for about 25 years and it seems likely that a considerable proportion of the esterified phosphate had hydrolysed to inorganic phosphate during that time.

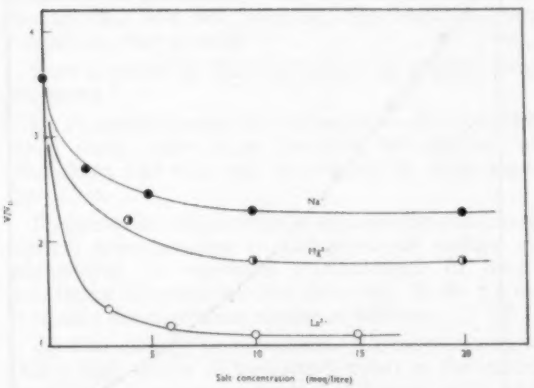

Fig. 6.

The electroviscous effect of electrolytes on the activity (at 50 p.p.m.) of a potato starch added from a solution containing 7 g/litre with various concentrations of NaCl, $MgCl_2$ and $LaCl_3$.

The arrowroot and cassava starches are very much less active than any potato starch but from figure 5 they apparently show the same relationship between activity and organic phosphate content. It is known that the three root starches have approximately the same ratio of amylopectin to amylose[22] but there are no data available to allow a comparison of either molecular weights or degrees of branching.

(*ii*) *Properties of the Solution.*

The activity of any starch solution depends upon both the nature and the concentration of any salts present in that solution. The effects of increasing concentrations of NaCl, $MgCl_2$ and $LaCl_3$ on the activity of a 7 g/litre potato starch solution are shown in figure 6. It is seen that 10 meq/litre of La^{3+} almost completely removes the activity of this starch solution. These effects are not obtained if the limed and boiled juice is subjected to high speed blending after the addition of the starch (50 p.p.m.). In this case the starch solution is allowed to come to equilibrium with its environment (of high electrolyte concentration) which swamps the electrolyte effects described here. It is presumably for this reason that the blending diminishes the flocculating action of starch.

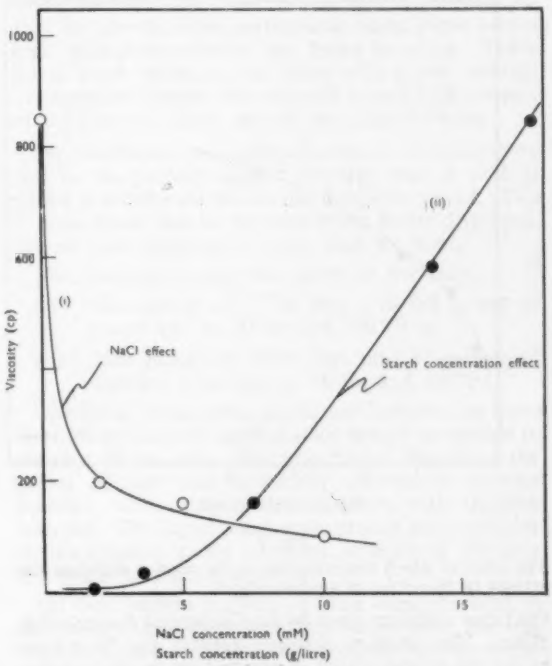

Fig. 7.

(Curve i) the effect of added NaCl on the viscosity of a potato starch solution containing 17·5 g/litre; (Curve ii) the effect of starch concentration on viscosity in the absence of electrolytes. Viscosites were measured at 30°C.

The change in activity with cation concentration and valency is paralleled by a change in viscosity; this is shown for NaCl in figure 7 (curve i). The latter is an expression of the well-known electroviscous effect[23] and it is here suggested that the flocculation and viscosity effects are closely related. It is imagined that in the absence of electrolyte the negatively charged phosphate centres in the amylopectin residue are able to exert their greatest electrostatic effect upon each other so that the macromolecule

[22] Whistler and Smart: "Polysaccharide Chemistry", (Academic Press, New York) 1953, p. 242.

[23] Overbeek and Bungenburg de Jong in "Colloid Science" Vol. II, ed. Kruyt, (Elsevier, Amsterdam) 1949. p. 203, 206.

tends to assume its most extended form. In this case, both viscosity and flocculating activity are greatest. The addition of electrolyte brings about a compression of the double layer around each charged centre so that their electrostatic effects are diminished and the flexible amylopectin structure contracts; trivalent La^{3+} has the greatest effect.

The activity of any starch solution also depends upon the starch concentration in that solution. Clearly a concentration of 50 p.p.m. in 1 litre of juice may be achieved either by an addition of 25 ml of a 2 g/litre starch solution or by an addition of 2·5 ml of a 20 g/litre starch solution; it is found that

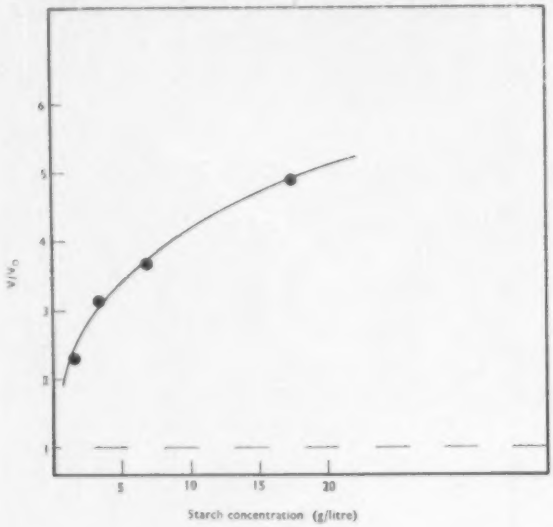

Fig. 8

The effect of starch concentration in the *solution added* on the activity (at 50 p.p.m.) of a potato starch.

the latter addition gives by far the largest flocculation effect. The relation between activity (at 50 p.p.m. in the juice) and starch concentration in the *solution added* is shown in figure 8. In this case, although the viscosity does increase rapidly with starch concentration, as shown in figure 7, curve ii, the two effects do not run parallel. This is reasonable since it is to be expected that whereas changes in viscosity reflect changes in the association between solvent and solute, changes in flocculation activity can only reflect changes in the association between solute molecules. The concentration effect is lost if the juice system is blended after addition of the starch, for the macromolecular aggregates are broken down before they interact with the particle system in juice.

Closely related to the concentration effect is the loss of activity in a starch solution on standing over a period of about a week. The magnitude of the effect is shown in figure 9 and it is seen that after 8 days, the starch solution used no longer affected sedimentation in the limed and boiled juice. It is suggested that this effect is associated with the phenomenon of retrogradation[24] which can be regarded as a precipitation leading to the dissociation of *solute* amylopectin aggregates.

On the basis of the effects described above it is suggested that the action of starch as a flocculating agent may be likened to that of a net in which the pre-formed defecation flocs are trapped. The "mesh" of the net is determined by the spatial separation of charged phosphate centres in the amylopectin residues, while the "capacity" of the net is determined by the size and shape of the amylopectin aggregates added. It is clear that while the organic phosphate content of the starch affects only the former and the degree of molecular association affects only the latter, both are determined by the magnitude of the electroviscous affect. Since it has been demonstrated that the particles in juice always carry a considerable amount of adsorbed calcium[25], it seems reasonable to conclude that the amylopectin aggregates are bound to the surface of preformed flocs through their phosphate centres (probably by a calcium phosphate salt linkage) while flocs are cross-linked by starch-to-starch bonds which already existed in the starch solution added.

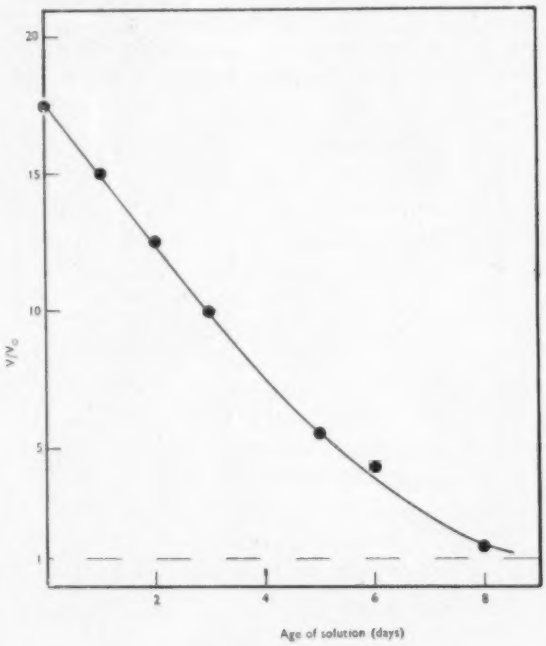

Fig 9.

The effect of retrogradation on the activity (at 350 p.p.m.) of a 17·5 g/litre potato starch solution.

From the discussion above it follows that the effectiveness of starch flocculation depends upon the preservation of conditions which existed in the starch solution added and it is clear that, once formed, the flocs must not be subjected to violent mechanical agitation.

[24] Ref. 22, p. 256.
[25] BENNETT: *Chem. and Ind.*, 1957, 1098; *I.S.J.*, 1958, **60**, 176.

FILTRABILITY OF RAW SUGAR

A Review of Recent Work Done by The Colonial Sugar Refining Co. Ltd.

By C. W. DAVIS, Chief Chemist, C.S.R. Co. Ltd., Australia.

PART II

Chemical Engineering Investigation of Clarification

This section may best be introduced by describing a significant experiment, perhaps better described as a significant demonstration. This arose as follows:

We knew that one of our mills was making sugar of low filtrability, and was also contravening some of the principles laid down for process control—for example, pH control was poor.

It was not known how much improvement would result if the necessary time and money were expended in overcoming these objections by alterations and additions to factory equipment.

We therefore decided to take samples of factory mixed juice and clarify them on the small scale by the "normal" process intended for this mill, namely liming, heating, boiling, and settling.

The small-scale process consistently gave better juices than the factory, and we asked ourselves what could be the difference. What was happening in the factory that was not intended, and what was not happening that should?

Over a period of time, the following subjects were evaluated :

(1) *Phosphate content of Mixed Juice*—Even on the small scale, some juices benefited by addition of phosphate, and this may be relevant to large scale operation.

It appears that juices require an available phosphate content corresponding to 150 parts per million of phosphorus for optimum clarification. In juices containing considerably less than this, 20–40 p.p.m. is usually the maximum economic addition.

(2) *Floc damage by turbulence.*—Calculations show that a high degree of turbulance exists in the mixed juice pumps and in the heaters of typical mills, and this may be expected to damage floc and so hinder clarification.

Laboratory experiments have shown this to be so, as when limed and heated juice was submitted to measured turbulence, the resulting "clear" juice contained a greatly increased amount of suspended matter.

It does not appear practicable to avoid a deleterious degree of turbulence in the heaters, and the remedy is therefore to delay the formation of most of the floc, by deferring liming until after heating.

This has been proved to be successful in laboratory experiments. Until these experiments were conducted, we did not know what would be the fate of that portion of the floc formed when unlimed juice was heated. It now appears that this floc does break up, but becomes enveloped by the calcium phosphate floc that forms when lime is added after heating.

(3) *Liming Control.*—It is thought that ineffective liming control will allow soluble phosphates to pass into the clear juice, and so into the raw sugar.

To avoid this requires automatic control of pH, and also provision of equipment to mix lime and juice. These measures are sometimes thought to be unnecessary for clarification, particularly when juices with a high phosphate content are being handled. These juices easily yield a clear juice with a low content of suspended matter, but may still have a high content of soluble phosphate due to inadequate liming.

(4) *Saccharate lime.*—Experiments in the laboratory and in the factory suggest strongly that if lime is added as saccharate the clarification is improved. This is presumably due to the lime being better dispersed, and so more available to react with the juice.

The saccharate used was made in two ways :

(i) One gallon of 20°Bx lime plus 0·8 gallon of liquor (65 to 70°Bx and 130°F) or

(ii) One gallon of 20°Bx lime plus 10 gallons of clarified juice (14 to 16°Bx and 190°F).

The latter is not true saccharate however, as some 40 to 50 gallons of clarified juice would be needed to dissolve all the lime. The quantity of 10 gallons per gallon of lime was nominally selected to prevent possible overloading of the clarifiers with recycled material. The liquor saccharate proved more suitable in this respect, giving complete solution of the lime in a small volume of material.

(5) *Gas bubbles in Floc.*—It had been observed in the factory that when lime was added after heating, and well mixed with the juice, the juice quality sometimes improved, but mud levels in the clarifiers rose prohibitively, and fell only when the liming point was changed.

This was puzzling, and much speculation led to the suggestion that the light floc may have held gas bubbles. Some support for this came from the observation that the subsiders sometimes belched gas, which disturbed the mud and caused gross carry-over of insolubles.

This suggestion has now been thoroughly tested, and it is evident that many "flash boxes" preceding clarifiers are not removing gas efficiently enough to enable a well formed floc to settle, as such a floc envelops bubbles of gas. This presumably compels the operator to adopt a liming technique that gives a damaged floc, which does not envelop much gas, and which then settles at a faster rate, but gives a less clear juice.

The importance of this factor may well vary from factory to factory, but it is thought to be a likely

source of trouble in many factories where high mud levels and clear juices occur together.

(6) *Conclusions regarding Clarification.*—The above considerations lead us to pose the following hypothesis as a means of improving the process :

(1) If laboratory clarification tests indicate phosphate deficiency in juice, add 20–40 p.p.m. of phosphorus as superphosphate. The ideal content of available phosphate in juice is thought to be around 150 p.p.m. (as phosphorus).
In juices containing considerably less than this figure it does not appear economical to add more than 40 p.p.m.

(2) Heat juice.

(3) Degasify juice (by giving attention to "flash-box" equipment).

(4) Add lime, as saccharate, into a positive mixing device, which gives sufficient mixing to flow a representative sample past the pH electrodes, but does not impart sufficient turbulence to break the floc.

(5) Control pH automatically, and ensure that available phosphate in clarified juice is below 15 p.p.m. (as phosphorus). (In measuring pH, it is advisable to protect the electrodes against excessive temperature by passing some of the boiling juice through a small cooler to the electrode cell).

Sugar Boiling

We have been interested in crystallization rate studies over a number of years[13,14,15]. This work has included a study of the manner in which various impurities, "soluble" and "insoluble", are taken into the sugar crystal.

Obviously if we ultimately succeed in obtaining no inclusion in the crystal, in raw sugar mills, we shall have made a major advance, as the affined sugar will be 100 per cent pure.

In this present context, we wish to consider merely how to exclude those impurities which impede filtering properties.

Up to the present time, it appears that the remedy accepted by most workers in this field is to avoid under-saturation during boiling[16]. This is relatively easy in a laboratory pan,[17,18,19] but may prove extremely difficult, if not impossible, in to-day's design of factory pan[20,21]. Moreover, it does not appear that this remedy applies specifically to filtration-impeding impurities. The same can be said for other measures to avoid inclusions such as boiling smaller crystals, which are said to be less "faulty" and so more pure.

The subject requires basic research, and much requires to be done in both the practical and theoretical fields, in studying inclusions of various classes of impurities, in relation to the boiling process.

Basic Research

The natures and the origins of the substances causing raw sugars to filter badly are still being investigated as part of the Company's programme of research into the natures and origins of all the non-sugars in process materials.

When we have established the nature and origin of a non-sugar, we shall then be able to consider whether it is deleterious, and if so, whether its entry to the factory can be prevented. If its entry cannot be prevented, our knowledge of its nature should enable us to consider means for eliminating it or avoiding its deleterious effect, either in the mill or in the refinery. Our current research programmes give us considerable hope in this direction, but we feel that there is yet a considerable amount of work to be done.

Conclusions.

It appears likely that many mills could improve the filtrability of their raw sugars by reducing the amount of suspended matter passing over from the clarifiers in the clarified juice.

In attempting to do this, the first step is to analyse the existing process extremely carefully, and see if it is doing what it is thought to be doing :

Is there enough available phosphate in the mixed juice ?

Is there too much phosphate in the clarified juice ?

Is gas being removed from the juice before liming ?

Is the lime being properly mixed with the juice ?

Is floc being damaged ?

Is clarification in the factory as good as by the laboratory-scale test (lime with saccharate, boil 3 minutes, and settle at 212°F) ?

Is the cane stale ?

Once the miller is satisfied that he is not allowing undue amounts of insoluble matter to pass the clarifiers, the problem of further improving filtrability needs careful analysing. This analysis will be peculiar to the circumstances at his mill, and may require extensive investigation.

Acknowledgments

The writer wishes to thank the management of The Colonial Sugar Refining Co. Ltd. for permission to publish this review of the work of the Company's staff.

ADDENDUM

A supplementary bibliography of selected papers is included to assist those interested in further reading on the subjects.

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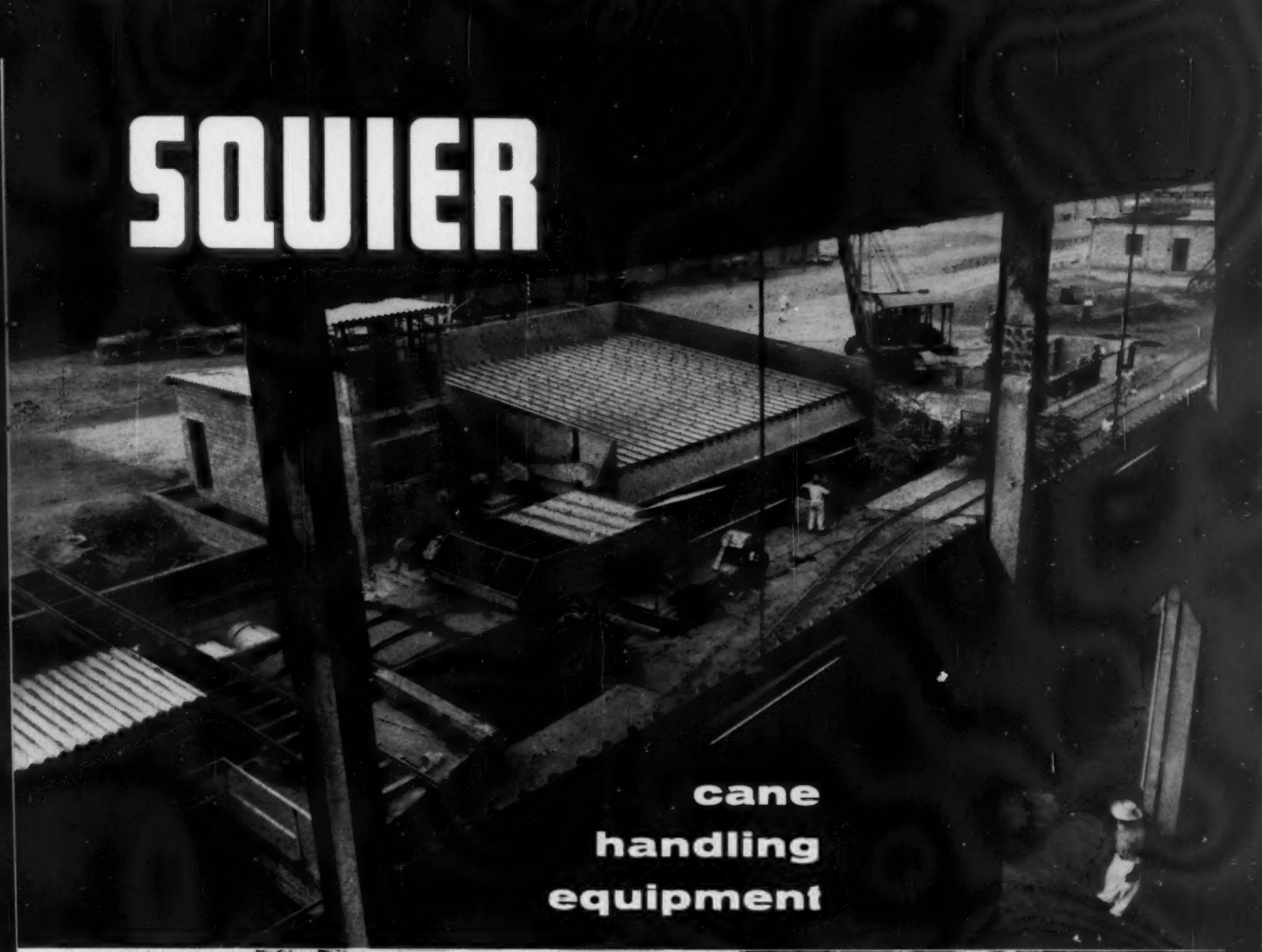

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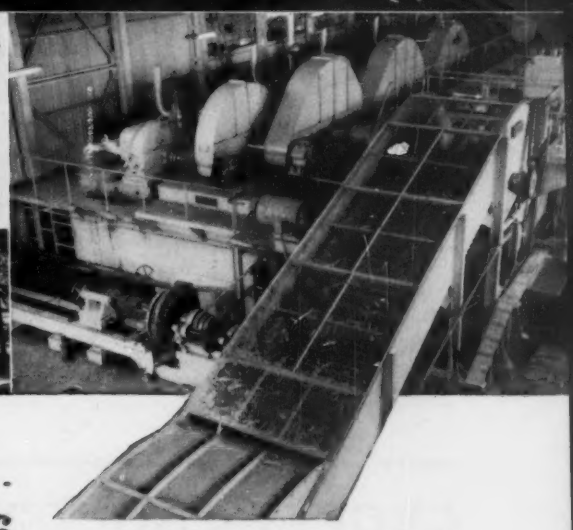

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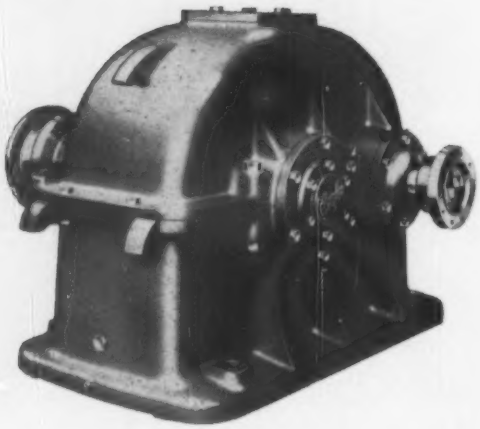

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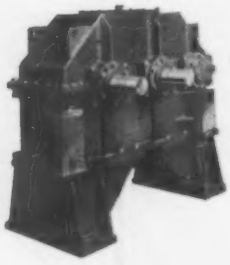

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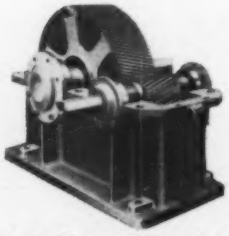

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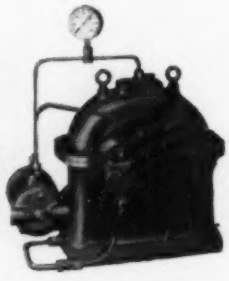

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STUDIES ON PROCESS CONDITIONS INFLUENCING CARBONATATION OF BARIUM SACCHARATE SUSPENSIONS

By G. N. BHAT, Lecturer in Chemical Engineering, Indian Institute of Science, Bangalore-12.

IN an earlier publication[1], data were reported on the carbonatation of barium saccharate suspensions in dilute sugar solutions. An analysis of those results indicated that the bubbling of carbon dioxide through the saccharate suspensions carried the carbonatation almost to completion, whereas the operation was a failure when the stream of carbon dioxide was made to rise through falling streams of saccharate suspensions.

This paper presents data collected during the previous studies on the carbonatation of saccharate suspensions with a view to determining the effect, on approach to equilibrium, of bubbling carbon dioxide at different ratios of gas rates to amounts of suspension desired to be carbonatated.

Apparatus, Procedure and Data

The arrangement of the apparatus is shown schematically in Fig. 1. Pure carbon dioxide gas was drawn from a cylinder and regulated by a reducing valve. The flow of the gas was metered by a calibrated rotameter, and the gas was fed to the reaction vessel through an inlet pipe fixed centrally on the bottom of the vessel. The reaction vessel was sealed at the top and the unabsorbed gas was made to bubble through a visible water-sealed bubbler. A closed-steam coil provided the required heating of the suspension, whenever desired.

In all experiments 10% suspensions of barium saccharate in water were used as the initial charge. Experiments were carried out at two different series of conditions. Series A investigations were conducted with 4 lb suspension being carbonatated at a carbon dioxide feed rate of 0·044 cu. ft. per minute at N.T.P. Carbonatation of 1·5 lb of the suspension with carbon

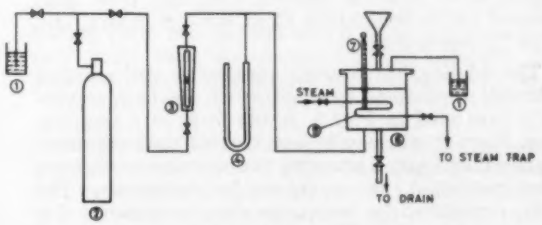

FIGURE 1

dioxide at a feed rate of 0·009 cu. ft. per minute at N.T.P. formed Series B experiments. During all the runs, the carbonatation temperature was kept at about 30°C. Data presented for each of the series were obtained through at least 10 carbonatation runs.

Percentage conversion of saccharate at different intervals of carbonatation were determined and the results are presented in Fig. 2.

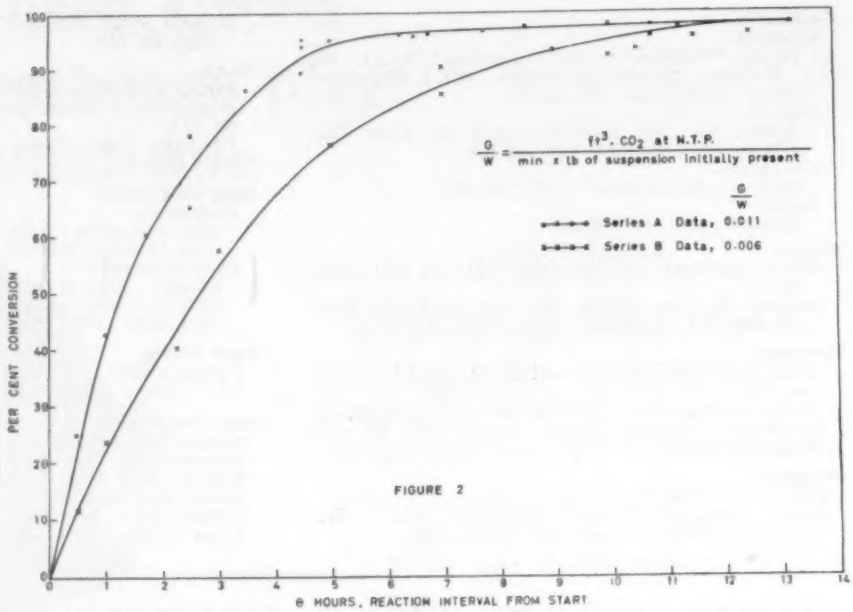
PER CENT CONVERSION
θ HOURS, REACTION INTERVAL FROM START
G/W = ft³, CO₂ at N.T.P. / min x lb of suspension initially present
G/W
Series A Data, 0.011
Series B Data, 0.006

FIGURE 2

Analysis of Data

The basic reaction involved in the carbonatation of barium saccharate can be represented by the following stoichiometric relationship:

$$Ba(C_{12}H_{20}O_{11}) + H_2O + CO_2 \rightarrow C_{12}H_{22}O_{11} + BaCO_3 \quad \ldots\ldots\ldots\ldots (1)$$

Thus it can be seen that the carbonatation reaction is essentially a first order reaction when excess of water and carbon dioxide are present. However, at the very beginning, the reaction is probably effectively a zero order process, the reaction rate being limited by the rate of supply of carbon dioxide ; and, as soon as the reaction rate is less than the supply rate of carbon dioxide (the condition probably existing for the data given), the reaction would appear to be of first order, since carbon dioxide gas and water are present in excess. Inasmuch as high percentage conversions are desired in any case and in view of the fact that conversions of the order of 98% have also been obtained during these studies, assuming constancy of liquid volume, the progress of the reaction may be represented by

$$\ln \frac{98}{98-x} = K\theta, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where K = reaction velocity constant, θ = time interval of carbonatation from start in hours, and x = % conversion.

The relationship between conversion and reaction interval, represented by equation (2) has been graphically presented in Fig. 3, in the form of a semi-log plot. From this it may be seen that the data are rather scattered and hence attempts to determine coefficients from individual runs would not be worthwhile. The data, considered by series, do show a tendency for a straight line plot. There is a definite indication of segregation according to series, with Series B data exhibiting a better straight line relationship at a lower ordinate and slope than Series A data. The latter as a matter of fact, has a noticeable trend towards a downward curvature. Drawing mean lines, by the method of least squares, for Series A and Series B data, the slopes for lines representing data of Series A and Series B are found to be respectively 0·617 and 0·330. Therefore, $(K)_A/(K)_B = 0{\cdot}617/0{\cdot}330 = 1{\cdot}87$. From the experimental conditions used it can be seen that $(G/W)_A/(G/W)_B = 0{\cdot}011/0{\cdot}006 = 1{\cdot}86$.

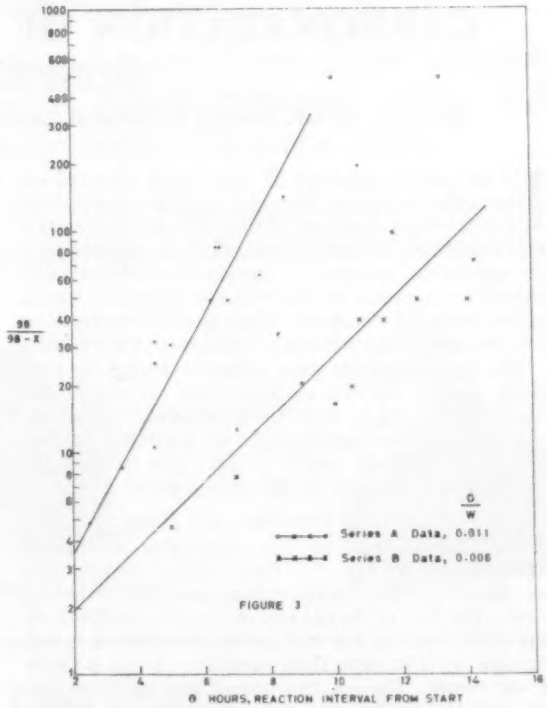

FIGURE 3

Therefore, it appears that the K values may be tentatively considered to be directly proportional to the G/W ratio.

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Discarding of Pushers. C. J. ALLEN. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 63–65.—Pushers were adopted generally by the Queensland industry and gave higher crushing rates and extractions. The recent trend is toward their elimination and/or replacement by pressure feeders, apron feeders and Donnelly chutes, and the author believes that this is not a reasoned change, since insufficient attention has been paid to understanding the working of the pusher and determining the conditions for its optimum effect.

* * *

Preliminary Bagasse Tests in the Two-roller Experimental Mill. C. R. MURRY. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 67–72.—Milling cane and bagasse of various fibre contents was compared in a series of experiments. It was found that the reabsorption factor (volume of bagasse per min/escribed volume per min) decreased linearly with increased fibre content of feed, and also with decreased speed and decreased filling ratio (fibre volume/escribed volume). It is possible that the slope of the reabsorption factor-fibre content line is steeper at lower fibre rates, but this might be a preparation effect.

* * *

Corrosion Fatigue of Metals and its Effects on the Sugar Factory. D. S. SHANN. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 73–79.—S – N (stress – failure cycle number) curves were drawn for mild steel in air and in contact with juice and molasses. These show that mild steel in contact with any sugar product or bagasse must become subject to corrosion fatigue. General preventative measures are discussed and, in particular, synthetic resin and sprayed metal coatings, shot-peening and skimming of mill shafts, and cathodic protection are suitable for sugar factory applications. One of the best safeguards is the use of an ultrasonic or similar crack-detector.

* * *

New Centrifugal Installation at Millaquin. A. H. JOHNSON, W. JOHNSON, A. P. SARANIN and F. M. LOHNING. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 105–110.—An account is given of the design and operation of a new high-grade centrifugal station with automatic recycling Ward Leonard drive.

* * *

Practical Installation of Capacitors in a Sugar Mill. R. DIPLOCK. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 111–115.—The average load on the Pleystowe alternator was 1650 kVA in 1957, for a kW output of 1150 (0·7 p.f.). Various means of increasing the p.f. were considered and it was found that individual connection of static condensers (capacitors) was the most economical.

* * *

Power Distribution in Industry by Mineral-Insulated Metal-Sheathed Cables. K. A. WILSON. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 117–125.—Construction, application, advantages, and installation of mineral-insulated copper-covered cables in a number of industries are discussed, together with concentric wiring and the suppression of voltage surges.

* * *

Glass-Fibre Reinforced Plastics.—Their Application in Sugar Mills. J. ROGERS. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 127–130.—Construction and properties of glass-fibre laminates are discussed and a list given of applications in sugar factories to combat corrosion of metals and concrete and the high unit weight of steel.

* * *

Conductivity Control—How Does it Work? G. H. JENKINS. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 143–148.—The conductivity method of indicating supersaturation is discussed in relation to conductivity—supersaturation—viscosity relationships which are illustrated by laboratory tests with solutions of electrolytes with added sucrose at varying concentrations. It is concluded that resistivity gives a practically linear indication of supersaturation which is only slightly affected by changes in temperature. In this respect it has advantages over the boiling point rise method which measures concentration rather than supersaturation and indicates the latter only if the temperature is constant.

* * *

Crystallization Studies. D. H. FOSTER, B. D. SOCKHILL and A. J. WILLERSDORF. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 149–153.—The relationship between crystallization rate and molasses purity was examined for B and C massecuites from 15 factories; these indicated that the rate was approximately halved by a fall of 5 units in true purity. On cooling B-massecuites, the purity dropped rapidly; consequently, water-cooled crystallizers could be used to give a purity drop of 1 unit per 5–7°F fall in temperature, and even standing a normal B-massecuite without cooling would reduce the purity of the molasses by 2–4 units in 2 hours. The viscosity rises with a drop in temperature, however, so adoption of cooling would depend on centrifugal capacity. Above 1·13 supersaturation the crystallization rate is much

greater at higher temperatures so that above this supersaturation, maintenance of a higher temperature should help to achieve rapid sugar recovery in the crystallizer or pan. The appearance of dendritic growths on crystals has been noted at supersaturations of 1·20 and higher. This corresponds to the limit of the metastable zone and new grain would presumably be formed by separation of these dendritic growths from the bigger crystals.

* * *

Selection, Installation and Maintenance of Worm Drive Units. K. H. SHUTE. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 155–161.—Features of worm reduction gear drives are discussed.

* * *

Some Problems Associated with Mill Gearing Design. G. E. HORSBURGH. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 163–166.—Design, wheel proportions, materials, heat treatment, tooth finish and lubrication of mill gearing are discussed.

* * *

Mill Roll Bearing Lubrication. L. H. POMROY. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 167–171.—Basic principles of lubrication are briefly discussed with their applications to cane mill rolls. The type of lubricant needed is considered and characteristics given for lubricants for use in a centralized lubrication system. Advantages of compounded mineral oils are mentioned.

* * *

Notes on the Use of Oil Burners at Moreton Mill. T. M. REDMOND. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 173–175.—Auxiliary oil burners were installed at Moreton mill, and factors governing the design and construction of the installation are discussed.

* * *

Removal of Suspended Solids from Mixed Juice. P. G. WRIGHT. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 177–182.—Investigations were made using a 6-inch "Dorrclone" hydroclone for removal of sand and silt from mixed juice. It was found that at 20 p.s.i.g. feed pressure the machine could handle 60 gal/min, extracting over 90% of, sand coarser than 150-mesh, or 50% of the total sand, with 0·5—2·0% of the mixed juice throughput. Sand finer than 250-mesh and bagacillo were not efficiently removed. It is highly important to wash the juice from the separated solids in the underflow. Of the methods suggested the continuous filtration system would be the ideal, but the economical solution might be a settling cone method. A simple but effective settling cone has been proposed which could be incorporated with manual or automatic regulation into an effective washing system.

* * *

Operation of a Sand Settler at Kalamia. B. J. RUTHERFORD and D. J. MUIR. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 183–187.—Considerable difficulties were caused in 1957 by the presence of sand in mixed juice, resulting from rain during harvesting, which settled in the juice tank, choked filter screens, etc. To avoid this a settling trough was constructed, with a paddle scraper to raise the sand from the bottom and discharge it to a wash tank to which water is added for sweetening-off. The sand is removed from the wash tank by a second paddle scraper and discharged to a hopper before loading into trucks for disposal. The sand in juice was reduced by 88–89% for 48–65 mesh material and 60–66% for 65–150 mesh material, and considerable savings were achieved by avoidance of wear and choking of pipes and of the need to stop the filters for cleaning several times in a week.

* * *

Boiler Water Control—Developments in Internal Treatment. C. HINCHCLIFFE. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 189–194.—Recent anti-scale and anti-corrosion techniques and treatments are briefly described; these include R.D. treatment (magnesium + alkali + antifoam), conditioning after base-exchange softening, antifoams, volatile and filming amines, hydrazine, and fire-side additives.

* * *

System of Continuous Addition of Chemicals to Boiler Feed Water. B. L. WRIGHT. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 195–197.—Chemicals are pumped into the feed line through a clear plastic tube from a 30-gallon tank which contains a shrouded propellor for circulation and a perforated cylinder into which the flake caustic soda and trisodium phosphate is added in batches corresponding to 10 gallons of water. The tank has a glass gauge calibrated in 10-gallon sections, and water and chemicals are added when the level falls between the 30- and 20-gallon levels.

* * *

Cooling Towers. H. HORTON. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 199–204.—The function, theory, design and construction of mechanical-draught water cooling towers are described and discussed.

* * *

Entrainment Prevention at Gin Gin. R. F. BEALE. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 205–207.—The juice feed inlet to a floating-calandria pan at Gin Gin was above the top tube plate, and this led to appreciable entrainment because of the impingement of the inlet stream on the central vapour downcomer, droplet formation and flashing. A very marked reduction in carryover was achieved by fitting a baffle over the inlet, and further reduction was obtained by installing a simple wooden maze separator in the top part of the pan body.

* * *

Further Experiments on the Self-Feeding Characteristics of the Two-Roll Experimental Mill. C. R. MURRY. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 209–214.—Experiments

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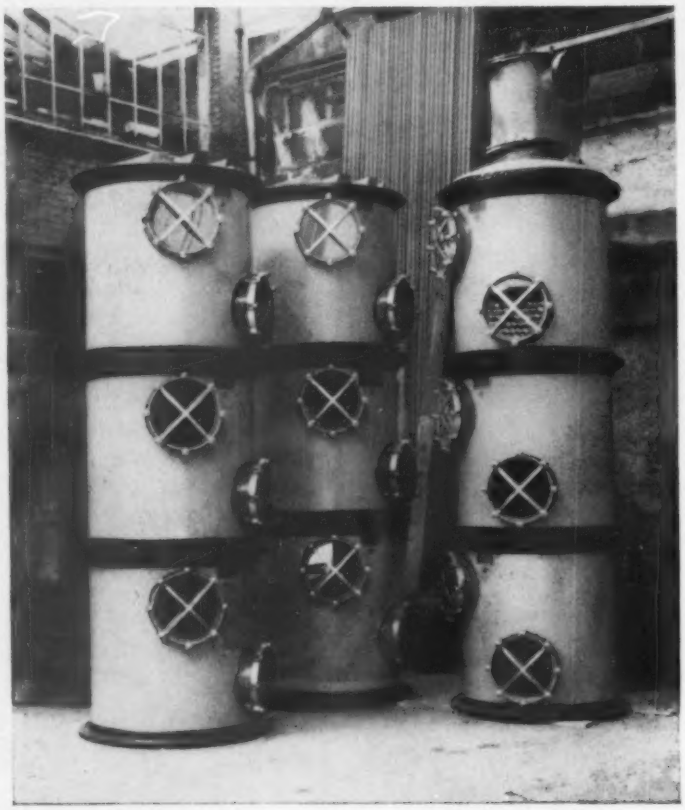

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show that the maximum feeding rate for the experimental mill rises linearly with escribed volume whether this is achieved by increasing the speed or enlarging the work opening. The rate of increase of maximum rate is greater when increasing the speed. Both the increases are accompanied by a decrease in extraction. If the speed is increased but the work opening decreased, so as to maintain the same escribed volume, the maximum feeding rate increases while extraction increases up to a point and then falls. An increase in maximum rate, accompanied by increased extraction, is obtained with increasing fineness of preparation; however, the rate increase is small compared with those found by increasing escribed volume or speed at constant escribed volume. The point of maximum extraction found on increasing speed at constant escribed volume has not been encountered with the three-roller mill of the Sugar Research Institute; this might be due to the fact that the speeds used have not been high enough.

* * *

The Division of Roller Load in Three-Roller Mills. W. R. CRAWFORD. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 215–222.—The ratio of delivery roll load to feed roll load has been calculated by various authors and values ranging from 2 : 1 to 40 : 1 recorded in the literature. Three new methods are examined to find the ratio. In the first of these the first roller opening is set to give 25% extraction (this corresponds to a roll load of 12,000 according to Bullock's experimental data). On passing through the delivery roll opening the extraction is increased to 66%, corresponding to 47,000 lb loading. The ratio of loads are thus considered to be 47,000 : 12,000 or 3·91 : 1. In the second method, extraction at the feed roll is measured for a total loading of 21 tons, and the discharge roller then set away from the top roll so that the unit operates as a two-roller mill. By reduction of the load the extraction is brought to the same extraction as the original feed roll extraction. The loads on the feed roll and deliver rolls are calculated from the geometry of the mill and the original and final roll loading, and the ratio of delivery to feed roll load calculated as between 2 : 1 and 3·5 : 1. In the third method, the actual loads are measured by means of a load cell installed under a feed roller bearing and by means of the hydraulic jacking system on the delivery roller. Measurements show the load ratio to be between 3·93 : 1 and 4·78 : 1. Reasons for the discrepancy between press tests and load measurements are proposed.

* * *

Removal of Suspended Matter from Mixed Juice. *Tech. Rpt.* (Sugar Research Inst., Queensland), 1958, (45).—The results of tests with an experimental 2-inch "Dorrclone" used to remove suspended solids from mixed cane juice are recorded. The unit efficiently removed sand and silt and also the major portion of the bagacillo coarser than 150-mesh in the underflow, which represented 5% of the juice treated. Although the juices treated did not carry a heavy load of suspended solids during normal times, the quantity was greatly increased during rainy periods when end-loaders were employed in the field. It was concluded that tests with a larger unit were warranted and plans were made to continue the project during 1958.

* * *

Low Grade Crystallization and Sugar Recovery. *Tech. Rpt.* (Sugar Research Inst., Queensland), 1958, (46).—This records the results of practical crystallization experiments with C massecuites at a selection of Queensland mills. A miniature crystallizer (18 in × 9 in) was designed and built; massecuite could be cooled or heated by water circulated in the jacket, and effective stirring by means of four T-shaped paddles operating at 1·6 to 6·4 r.p.m. Procedure was to hold the massecuite in the crystallizer at pan temperature until crystallization was complete; then cool through about 35°F and hold at the new temperature until no further purity drop of the mother liquor occurs. Samples of molasses were obtained at intervals by means of a pressure filter to follow the course of crystallization by pol and Brix determinations. Finally the massecuite was reheated to simulate factory operation, with further sampling to determine degree of re-solution of crystal. Supersaturation of molasses at pan drop was usually in the range of 1·10–1·20; it was found that cooling through 35°F in a period of 2 hours did not cause false grain to form; on the average, true purity of molasses was reduced by 1 unit for each 6–8°F of cooling, and it was concluded that under present factory conditions, the only factor limiting practical exhaustion of final molasses is viscosity. A value of 1000 poises has been chosen as a reasonably high value for exhausted molasses, and for efficient work at the centrifugals, this should be reduced to about 500 by reheating the massecuite prior to curing. This normally involved reheating through 13°F. The speed of reheating is most important, and provided delays are avoided, the purity rise does not exceed 1 unit. Final true purities at the target viscosity varied with factory, ranging from 36 to 46. The effect of insoluble suspended solids in final molasses was found to have a profound effect on viscosity; removal of 5% of sludge from one molasses reduced the viscosity by almost one half.

* * *

Influence of Degree of Preparation on No. 1 Mill Performance. *Tech. Rpt.* (Sugar Research Inst., Queensland), 1958, (49).—The tests described aimed to determine whether shredded cane offered any advantages over knifed cane insofar as it affects No. 1 mill performance. It was concluded that (1) shredded cane will yield 2% more pol extraction due to a reduction in reabsorption loss at the delivery roll. (2) There was no evidence of an optimum degree of preparation. (3) No evidence was found to indicate any influence on crushing rate, but it would seem that with some slight precompression of the feed, a small gain might result due to the higher bulk density of the feed. (4) There is an appreciable reduction in the mill power required for a given extraction with shredded cane.

Beet Sugar Economics. R. H. COTTRELL. *Paper presented to the California Beet Sugar Tech.*, 1959.—The factors governing profit depends on the volume of production, cost per unit of production and net sale price of marketable products. Under U.S. conditions the first and last of these are strictly controlled and are not likely to provide significant improvement. In addition the costs of labour, materials, and transport, and taxes are all increasing. Since the largest single cost item—the amount paid to growers—is inflexible, and represents 71% of the total, only 29% of costs are subject to managerial control. The steps which can be taken to reduce these are discussed and reference is made to increasing beet yield per acre, sugar recovery from beet, capital investment to reduce labour, and fuel costs.

* * *

Water Purification Processes in the Sugar Industry. T. WINTZELL. *Ind. Alim. Agric.*, 1959, **76**, 177–181.—Details are given of return water purification and return schemes operated in the Swedish Sugar Corporation from the Dorr concentrator of 1951 to continuous Buckau-Wolf equipment installed in 1957 and 1958. Their efficiency is indicated in a table of B.O.D. values for the waters treated and untreated.

* * *

Juice Purification by Demineralization with Ion Exchangers. S. VAJNA. *Zucker*, 1959, **12**, 186–191.—The normal ammonium cycle ion exchange process has a disadvantage in the high regenerating costs and in the fact that the impurities removed cannot be separated from each other. A new process involves regeneration of the cation exchanger with ammonium carbonate, and addition of milk-of-lime to the resultant alkali carbonate to give an alkali hydroxide, which is then used to regenerate the anion exchanger. The costs of regeneration are comparatively low and a juice purity of 92·5 can be raised to 98·5–99·0, with 80% non-sugars removal, over 95% ash removal, and 70% colour removal.

* * *

New Type of Mechanized Beet Piling and Factory Experience during the 1958 Campaign at Sladkovicovo Sugar Factory. B. PETZ. *Listy Cukr.*, 1959, **75**, 102–105.—The installation, first put into operation in 1958, for reception, stacking, fluming and conveying of beet to the factory is described in detail. Provision is made for stacking 12,000 tons of beet (5 days requirements) and handling at 150–180 tons/hr. Closed circuit television has been installed for supervision of the installation.

Economics of Sugar Factory Machinery. IV. Waste Water Pulp Traps. O. BÖHM, O. LISY and L. SCHMIDT. *Listy Cukr.*, 1959, **75**, 114–118.—In comparative tests it was found that the best apparatus, both technologically and economically, for removing pulp from waste water was a so-called "trough pulp trap" which is to be put into mass production this year. The BMA pulp catcher is considered to be of advantage only when used in conjunction with a BMA diffuser.

* * *

Continuous Saturation Processes. E. PIAZZI. *Ind. Sacc. Ital.*, 1959, **52**, 74–83.—The characteristics of continuous carbonatation are discussed and the various types of installation reviewed.

* * *

Contributions to Heat Economy in the Sugar Industry. F. SCHLANITZ. *Zucker*, 1959, **12**, 223–231.—The factors affecting heat economy in relation to steam and electricity generation are discussed. Steam requirements on weight of beet depend largely on the evaporator system used, and the requirements of the first effect are approximately equal to the sum of the vapours withdrawn from the whole system. As little vapour as possible should be withdrawn for heating purposes; this permits the greatest amount possible to be compressed for use in electricity production. Vapour feed to the pans can be reduced by raising thick juice density, a change of 5°Bx being equivalent to 2% steam on beet for a 3-boiling scheme with 32% first product massecuite on beet. Regulation of thick juice Brix is discussed on the basis of factory operations at Tulln (Austria). Systems of evaporator and generator operation are compared with the aid of flow diagrams and calculations. The use of thermocompressors is recommended.

* * *

Control of the Evaporation Plant in the L.V. System. W. VON PROSKOWETZ. *Zeitsch. Zuckerind.*, 1959, **84**, 194–196.—Control of the L.V. system of evaporation, previously described[1], is discussed. This is based on the ratio of thin juice to the heating steam and on the thick juice Brix. A thin juice Brix meter may be used as impulse transmitter, with a flow meter as secondary impulse transmitter, or the latter on its own. The theoretical scale formation is dealt with and incrustation in the L.V. system calculated to be greater only in the 2nd effect and considerably less in the last stage, compared with the normal system.

[1] *I.S.J.*, 1959, **60**, 331.

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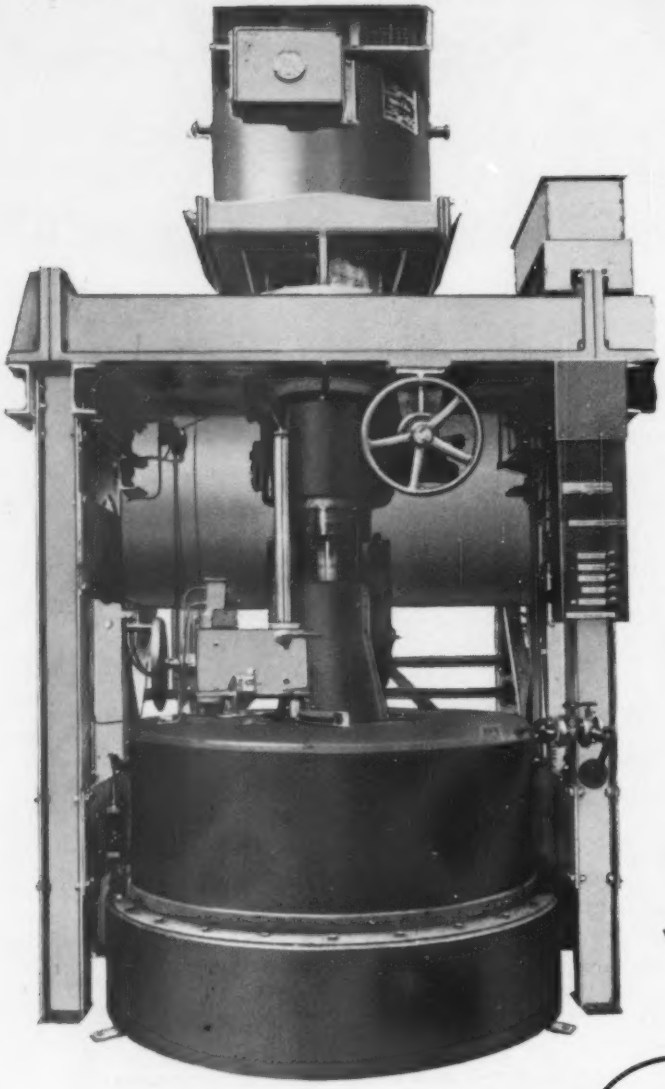

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Methods of Evaluating Continuous Diffusion Systems. P. FREUND. *Zeitsch. Zuckerind.*, 1959, **84**, 242—243. —For comparison of the performance of continuous diffusers, the Silin formula[1] is considered most suitable, while four parameters are given for evaluation of power and heat requirements, effective diffuser capacity and purchase price.

* * *

Recent Developments in Carbonatation Juice Sedimentation and Allied Plant. N. M. ADAMS. *Paper presented to the 12th Tech. Conf., British Sugar Corp.*, 1959.—New carbonatation, sedimentation and filtration equipment is to be installed at two white sugar factories—Brigg and Ipswich. The filters are to be Dorr-Oliver rotary filters which will be modified by removal of the variable speed drive, introduction of a fine adjustment of the mud removal bar and redesign of the wash water sprays. Investigations into the relationship between filtration capacity and mud Brix are described. The new Dorr ATV clarifiers are to be installed; these are of very much shorter retention time, and their construction and performance in a number of European factories are compared with the older type of clarifier. The gassing tanks are illustrated and briefly described, and brief reference made to current European liming practice.

* * *

Effect on Juice Quality of Temperature of Liming and of Mud Recirculation. P. MOTTARD. *Paper presented to the 12th Tech. Conf., British Sugar Corp.*, 1959.—Tests were carried out in which the temperature of pre-liming and main liming was varied and the effect on the juice quality noted as a function of the changes in filtration coefficient, height of sedimentation, colour, purity, invert content, lime salts and saline coefficient. Cold preliming followed by cold main liming before heating gave better colour than when main liming was hot, while filtration and sedimentation were very little changed. Recycling of mud was found only to give poorer sedimentation. With hot preliming, sedimentation improved, particularly when mud was recycled; however the colour was considerably higher as was the invert sugar content. Return of over-carbonatated muds improved the filtration and sedimentation coefficients without, however, improving the colour to that achieved by cold total liming without recycling of muds.

* * *

Final Elements for Automatic Control in the British Sugar Corporation. R. M. J. WITHERS. *Paper presented to the 12th Tech. Conf., British Sugar Corp.*, 1959.—Control valves used by the Corporation are rubber diaphragm operated weir valves, globe valves with V port or parabolic plugs and butterfly valves. The characteristics of each are discussed and illustrated and it is explained why it is the first on which standardization is being pursued. The electric and hydraulic systems used for variable speed drives are described, and details given of control elements used for pressed pulp feed scrolls, sulphur stoves, and milk of lime wheels.

* * *

Some Studies of Pulp Pressing and Modern Pulp Presses. S. A. MORRISH. *Paper presented to the 12th Tech. Conf., British Sugar Corp.*, 1959.—The economic effect of efficient pulp pressing is discussed and illustrated by a table giving coal at 7000 cal % pulp dried; this reduces from 70·6 for pulp of 14% dry substance to 31·8 for 26% dry substance. The influence of sugar content of wet pulp on its dry substance content and the implications of this in pressing of the pulp are discussed. Comparative details are given of the design and performance of the standard press used by the Corporation, the S.S.A.–Landsverk press and the Weigelwerk press, and an account is given of trials with a small twin-screw press made by Stord-Marin Industri A.S., and various screens and a forced feed on the standard press. It is concluded that for each type of press there is a definite relationship between dry substance and capacity; the orifice size of the screen exerts a very definite influence on the dry substance; addition of $CaCl_2$ increases the dry substance by varying amounts and the optimum dosage should be found by experiment for each factory; and the results obtained in preliminary tests using a thin screen with fine holes are sufficient to justify more prolonged tests. The higher pulp dry solids obtained with the Stord press (4–5% increase) have encouraged the Corporation to experiment with a larger press which will be installed for the 1959/60 campaign. Brief mention is made of the Stearns-Roger press used in America.

* * *

Results of Comparative Tests and Evaluation of Vacuum Pans of Different Designs. M. L. VAISMAN, A. S. KOSTENKO and F. N. POLISHCHUK. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 3–28.—A ring-type vacuum pan designed and constructed by the Smelyansk machine factory was compared with a conical tube-plate calandria pan for the boiling of 2nd raffinade massecuite. Full details are given of the pan construction and the tests. With almost identical heating surface, syrup Brix and massecuite Brix and purity, the effective temperature difference and supersaturation coefficient of the mother liquor were greater in the ring pan than in the other; however, in spite of this, the calandria pan operated more successfully than the ring-type pan with a greater mean heat transfer coefficient for the completed cycle, shorter boiling time, lower colour formation and greater sugar uniformity although the sugar retained by the centrifugals was greater with the ring-pan massecuite. The rise in density and purity throughout the boiling are charted on graphs as are the steam consumption, heat transfer coefficient, and the dependence of heat transfer coefficient on steam flow. To improve the ring pan it is recommended that steam feed and removal of

[1] *I.S.J.*, 1958, **60**, 144.

condensate and incondensible gases be improved, and that the ring elements be better grouped to increase the heating surface. The operational defects are considered to be fundamental to all pans of this type.

* * *

Investigation of the Operation of Evaporators of Different Types. N. YU. TOBILEVICH and V. A. CHEBOTAREV. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 29–65.—The basic requirements of evaporators and the major factors influencing their efficiency are discussed on the basis of detailed investigations. The results of these studies provide information on the advantages and disadvantages of the various types of evaporators, and act as a guide to improvement of existing units as well as to future evaporator design. It was found that single-pass and segmental evaporators had no advantage over other types.

* * *

Choice of Formulae for Calculation of Heat Transfer in Evaporators. N. YU. TOBILEVICH. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 66–75.—A study of various formulae has shown that the experimental data of M. F. CICHELLI and C. F. BONILLA[1] on heat transfer to various liquids boiling over a wide range, including sugar solutions of up to 80% concentration, are best generalised by two equations of KICHIGIN & TOBILEVICH, combined into the dimension form:

$$\alpha_a = 3{\cdot}25 \times 10^{-4} \frac{g^{0{\cdot}125}\,\lambda^{0{\cdot}4}\,C^{0{\cdot}6}\,\gamma_f^{0{\cdot}267}\,p^{0{\cdot}7}\,q^{0{\cdot}6}}{r^{0{\cdot}6}\,\gamma_n^{0{\cdot}6}\,\nu^{0{\cdot}25}\,\sigma^{0{\cdot}363}}$$

where α_a is the absolute heat transfer rate coefficient in kcal/sq.m./hr/°C, g = acceleration due to gravity in m/sec/sec, λ = coefficient of heat conductivity in kcal/sq.m./hr/°C, C = thermal capacity, γ_f = fluid density in kg/cu.m., p = pressure in kg/sq.cm., q = specific heat flow in kcal/sq.cm./hr, r = rate of evaporation in kcal/kg, γ_n = steam density in kg/cu.m., ν = coefficient of kinematic viscosity in sq.m./hr, and σ = coefficient of surface tension in kg/m. The formula is illustrated by a nomogram.

* * *

Testing Automatic Temperature Regulators. B. A. EREMENKO and A. I. TSENZURA. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 76–94.—Tests were carried out on heating first carbonatation juice, using various types of temperature control, all but one of Soviet design. Detailed results are given with charts and diagrams, and recommendations made as to the best equipment for various applications.

* * *

Experimental Research on Steam Boilers of Average Pressure (22–39 atm.), fed with Ammoniacal Water. D. S. SHEVTSOV. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 100–131.—Full details are given of tests to determine boiler efficiency, water level fluctuation, pressure and temperature variation of superheated steam, quantity and quality of feed water and steam, and of methods of calculation of the rate of blow-downs. Two- and three-drum screened water-tube boilers were used, the former of 20 and 25 tons/hr nominal capacity and the latter of 30 tons/hr, using pressures of 26, 30–32 and 39 atm.

* * *

Tests on Automatic Combustion Control in Boilers with Manually-Operated and Mechanical Stokers. B. A. EREMENKO and A. I. TSENZURA. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 132–172.—Details are given of tests carried out on automatic control of induced draught, fuel:air ratio and steam pressure at two Soviet factories, one with a three-drum vertical water-tube boiler with manual stoking, and the other a mechanically-stoked cross-type water-tube boiler. Diagrams, tabulated data and graphs illustrate the improved operation of the boilers, and other advantages are mentioned.

* * *

The Effect of Sugar Factory Boiler Design on Steam Quality. D. S. SHEVTSOV, G. M. GLAGOLEV and L. A. ZALEVSKAYA. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 173–188.—Details and diagrams are given for comparative tests carried out on various types and sizes of boiler from various Soviet factories. It is pointed out that the majority of faults encountered are not due to using low-quality ammoniacal water but are a result of the design and operation of the boilers.

* * *

Purification of Sugar Factory Waste Waters in Three-Stage Biological Filters. A. F. CHEKURDA. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 216–245.—Tests made at Voronezh factory and the individual pieces of equipment used in waste water purification (settlers and bio-filters) are discussed. On the basis of the tests, a principal scheme, of which a flow-diagram is given, is suggested, involving the use of 3 bio-filters and 3 settlers. The waste water at Voronezh is highly polluted, the average $B.O.D._5$ being in the range 12,100–5450 mg/litre, i.e. 50–60% higher than at other factories. Nevertheless, results of the tests were satisfactory, the $B.O.D._5$ being reduced by 75% on average or 85% under normal conditions using chemical filtration. Two previously-described[2] re-circulation schemes are suggested: incomplete biochemical treatment in factories having ponds in which purification is completed by self-purification; and return of diffusion and press-waters to diffusion after treatment, with biochemical purification of the category III waste waters. Using these schemes the settler and pond space can be reduced by 20–30 times and the combined waste water reduced by 100–130% on beet, thus permitting reduction of the space required for purification by 50–60%.

[1] *Trans. Amer. Inst. Chem. Eng.*, 1945, 41.

[2] A. F. CHEKURDA: "Steps in the purification of waste waters and sanitary protection of sources of sugar factory water supply" (Pishchepromizdat, Moscow.) 1951.

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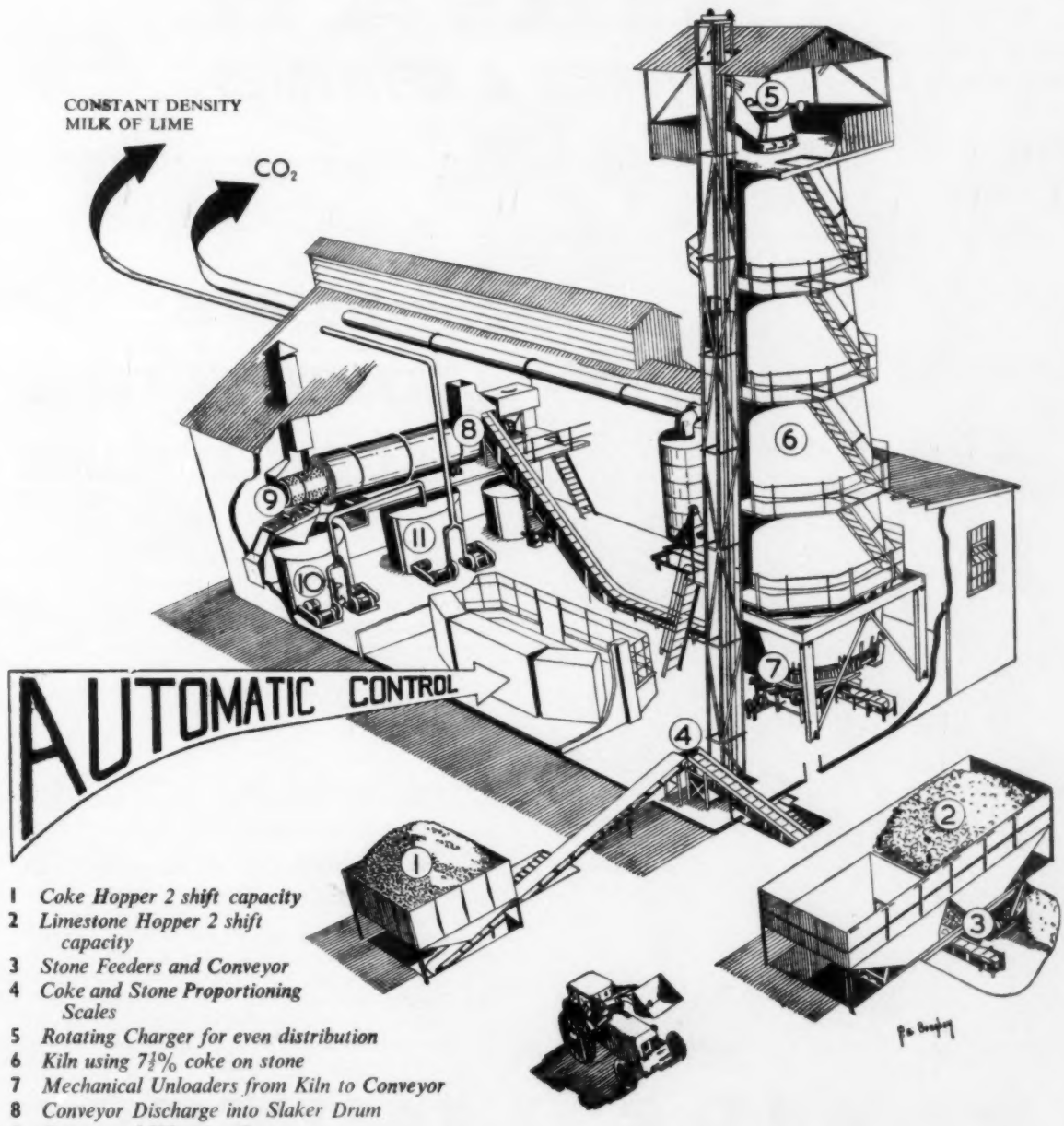

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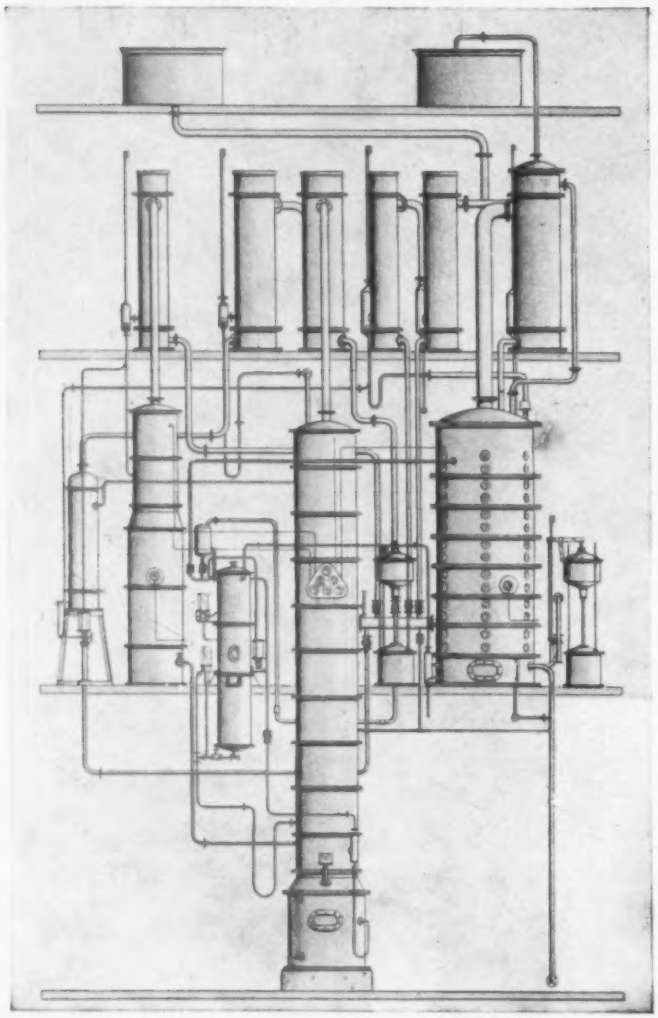

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Sanitary Conditions in Discharging Sugar Factory Waste Water to Open Ponds. A. F. CHEKURDA. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 246–257.—The discharge of factory waste water, purified by 3-stage biochemical treatment, to open ponds is controlled by certain regulations, based on the extent of pollution. The pollution criteria include the amount of suspended matter, smell, taste and colour of the effluent, dissolved oxygen, B.O.D., the pH and toxic substances in the water.

* * *

Investigation of Ways of Increasing the Durability of Tubes for the Sugar Industry. N. YU. TOBILEVICH *et al. Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **5**, 258–282.—See *I.S.J.*, 1958, **60**, 49.

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Preservation and Processing of Beet Harvested by Combine Harvesters. M. Z. KHELEMSKII *et al. Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 3–14.—Comparative tests were made on beet harvesting and storage using a SKEM-3 combine with subsequent topping, a SPT-3 combine (a modification of the SKEM-3), and using beet lifters with manual topping. Beet gathered by the SKEM-3 and stored was no worse than that obtained by lifters and manually topped, although molasses yield increased by 0·4–0·5%. The dirtier state of the beet calls for increased flume water at the factory and thorough beet washing, etc. The beet gathered by the SPT-3 combine was dirtier and more damaged so that it stored badly, cooled slowly, germinated to a greater extent, and suffered high sugar losses. Supplementary mechanical cleaning and forced ventilation of the piles is recommended, to improve storage. Comparative tests of foreign combines are considered necessary.

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The Effect of Certain Physiologically Active Substances on the Rate of Sprouting and on Sugar Loss in the Storage of Beet. M. Z. KHELEMSKII *et al. Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 15–25.—Treatment with 1·5—3 and 3·6—9 kg of α-naphthylmethylacetate dust per ton of beet before storage had no inhibiting effect on sprouting, sharply reduced the resistance to rotting, increased sugar loss and reduced the technological quality of the beet. Pre-harvest spraying of beet with maleic hydrazide had no effect on water retention and considerably lowered the rate of sprouting but reduced the resistance to rotting and did not reduce sugar losses, even raising them in some cases. Spraying mother beet with 0·3–0·6% maleic hydrazide 3 weeks before harvest and storage in trenches also lowers the rate of sprouting. Treatment of beet with 25, 50 and 100 g/ton of *iso*-propylphenylcarbamate reduced the sprouting rate but also lowered resistance to rotting and so increased sugar losses and invert content.

Operation of the Mandryko Single-Scroll Rotary Diffuser. E. T. KOVAL'. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 26–52.—The theory of diffusion is discussed mathematically and the problems of recirculation in rotary diffusers are investigated. It has been found that recirculation, which increases juice draught and sugar losses, is caused by resistance of the layer of cossettes to juice percolation. To overcome this, a Mandryko single-scroll diffuser has been modified, supplementary screens being installed in each half-cell along the drum wall and further lateral screens between the scroll and the drum wall, at right angles to the latter. Automatic cossette charging, with corresponding slicer control, is recommended. The amount of cossettes passing from one cell to the next should not be greater than would permit the juice-cossette mixture to exceed the height of the drum's central channel, as too large an amount again leads to recirculation of juice and cossettes. These measures have led to improved efficiency. For a single scroll diffuser, the capacity (A) is given by:

$$A = 0{\cdot}081\ D^3\ \frac{\gamma\ n}{1{\cdot}00 + 2\beta}$$

where D = drum dia. in metres, γ = density of the beet in kg/cu.m., n = drum speed in r.p.h., and β = draught. For double-scroll diffusers the drought factor is half that given above, i.e. β instead of 2β.

* * *

Kinetics of Diffusion of Sugar from Beet Cossettes at Different Extraction Liquor Velocities in the Free Space Between Cossettes. S. F. DRONOV. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 53–86.—Laboratory tests on the effect of diffusion liquor velocity through cossette columns on sugar extraction are discussed and formulae derived from the results[1]. The velocity increased with increasing pressure up to about 1·1–1·4 m water-gauge but thereafter was not appreciably altered. Increase of velocity (at low pressures) increased the mean extraction of sugar from 65·92% at 1·14 cm/sec to 81·50% at 7·12 cm/sec. Further tests were made to determine the effect of streamline flow over the surface of the cossettes during 30 minutes, and the relationship between extraction liquor velocity and molecular diffusion coefficient. In experiments using upward flow through a cossette column, an increase in velocity from 16·1 to 47·5 cm/sec increased sugar extraction from 36·85% to 60·67%.

* * *

Percolation Rate through Beet Cossettes of Different Characteristics. S. F. DRONOV. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 87–113.—Results of laboratory tests on percolation through beet cossettes are discussed. The apparatus was similar to that used in earlier experiments[2]. Factory cossettes of various shapes were used, the initial specific loading being 56 kg/hl at 70°C. The average

[1] See *I.S.J.*, 1958, **60**, 369.
[2] SICHEVOI: *I.S.J.*, 1956, **58**, 316.

retention time in the percolation vessel was 80–85 minutes. The results of seven series of tests are tabulated and given in graph form. It was found that the percolation rate falls sharply as the retention time increases where the cossettes are of the usual factory thickness (1–2 mm), irrespective of form or profile. Furrow-shaped cossettes sliced with 4-mm Chizhek knives and 3.6 mm Disston knives permit a higher percolation rate than cossettes sliced by 5 and 6 mm Chizhek knives or laminar cossettes 6 and 8 mm wide, other things being equal. The changes in specific loading of cossettes in batteries were studied in 4 diffusers, using automatic scales and a special probe inserted through the open top of the tail cell after sufficient diffusion water had been drawn off to allow the upper layers of cossettes to drain. A considerable drop in the height of the cossette column and resilience of the cossettes was noted in all cases, as in laboratory tests, while the specific loading increased from 55·5–56·0 to 73–77 kg/hl, only 72–82% of the effective diffuser space being filled. Pre-scalding of cossettes would permit the effective space to be used more fully. Laboratory experiments were carried out on percolation of water at 70°C through a rectangular column of cossettes 1200 mm high. Very little difference was found in the rate of percolation when up to 70–80% of the bottom screen area was blocked by cossettes, throughput being reduced from 20·72 kg in 3 minutes to 19·5 kg.

* * *

The Use of Ion Exchange Resins for Juice Purification in Beet Sugar Production. G. S. BENIN and N. N. KOSTENYUK. *Trudy Tsentr. Nauch.-Issledov. Inst Sakhar. Prom.*, 1958, **6**, 114–123.—Results of comparative laboratory tests on a number of ion exchange resins are tabulated and shown graphically. A KU-1 sulphonate cation exchanger (capacity 2·3 meq/g) operating on the sodium cycle and used with a weakly basic AN-1 carboxylic acid anion exchanger gave very slight decolorization and reduced the Ca salts to trace amounts. Subsequent anion exchange treatment gave a juice purity increase of 1–2 units on the original but only removed a small part of the ash and nitrogenous substances. While the use of the sodium cycle is not recommended for reducing sugar losses in molasses, it may be of advantage where the juice has a high lime salts content. EDE-10 anion exchanger (capacity 5·4–6·6 meq/g) was used with KU-1 resin in the reverse-bed technique; although the juice purity after the cation exchanger was an average of 3·9 units higher, the pH was very low (2·7 on average), so that the reverse bed scheme cannot be recommended. This was also the case when using AB-17 highly basic anion exchanger with KU-1 cation exchanger. This AB-17 resin, which cannot be regenerated with ammoniacal water, could be used successfully in a three-stage scheme following treatment with KU-1 and AN-1 resins. The two schemes considered most effective for juice purification are : KU-1 followed by EDE-10 anion exchanger, and KU-2 sulphonate cation exchanger (5·1 meq/g) followed by EDE-10 anion exchanger. Excellent results were achieved in a three-stage scheme using KU-1 resin followed by AN-1 and EDE-10 resins, although this is comparatively complex. Further studies are being made with other resins.

* * *

Choice of a Standard Massucuite Crystallizer for Treatment of Final Product Massecuite. A. A. ZHIDKOV, V. A. ZAMBROVSKII, A. D. GOLUBEVA and A. S. KOSTENKO. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 132–144.—The selection of crystallizers for low-grade massecuites is discussed and the best found to be those with rotary heat exchange elements. These elements must be streamlined to keep the resistance of the massecuites on increasing density and viscosity to a minimum and the difference between the temperature of the cooling water and the massecuite must be as low as possible. Two crystallizers were compared; one had discs mounted on a central shaft while the other, the SMZ, had groups of 3 annular elements mounted concentrically and inclined to the transverse plane of the trough. The disc type was found to be the better, yielding molasses of 60·0 purity and sugar of 96·1 purity and 57 colour while the SMZ yielded 60·2 purity molasses and sugar of 92·6 purity and 143 colour. The mean heat transfer coefficient in the disc type was 1·75 cal/sq.m./min/°C, and in the SMZ 0·70 cal/sq.m./min/°C. A scheme for continuous cooling and reheating in 4 disc-type crystallizers is suggested. The use of ammoniacal water as the heat exchange medium is recommended to prevent stoppages caused by deposition from raw water in the heating elements and to avoid local over-cooling in winter when the water temperature drops to 2–5°C.

* * *

Testing Low-Product Massecuite Crystallizers. YU. M. ZHVIRBLYANSKII. *Trudy Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1958, **6**, 145–155.—Comparative results show that the most most efficient of three discontinuous crystallizers tested was the Sangerhausen in which the rotary heat exchange elements are tubes bent to form spirals. The next best was the Skoda with disc elements inclined at an angle of 60° to the central shaft, while the Golovin-design crystallizer was found to be inferior to the others. This last machine has eight rotary hollow discs, each group of four being attached to a baffle mounted on a central shaft. The baffle scrapes any deposited sugar crystals from the bottom of the trough as it revolves round the shaft. The water flow is in series with the Sangerhausen elements but is distributed in parallel flow in the other crystallizers. The cooling and reheating transfer coefficients are: 0·63 and 1·15 cal/sq.m./min/°C for the Sangerhausen, 0·31 and 0·37 for the Golovin, and 0·31 for cooling in the Skoda crystallizer (no reheating coefficient is given for the Skoda). Maximum crystal content with the Sangerhausen was 53%, while it was 40% and 47·0% with the Skoda and Golovin respectively.

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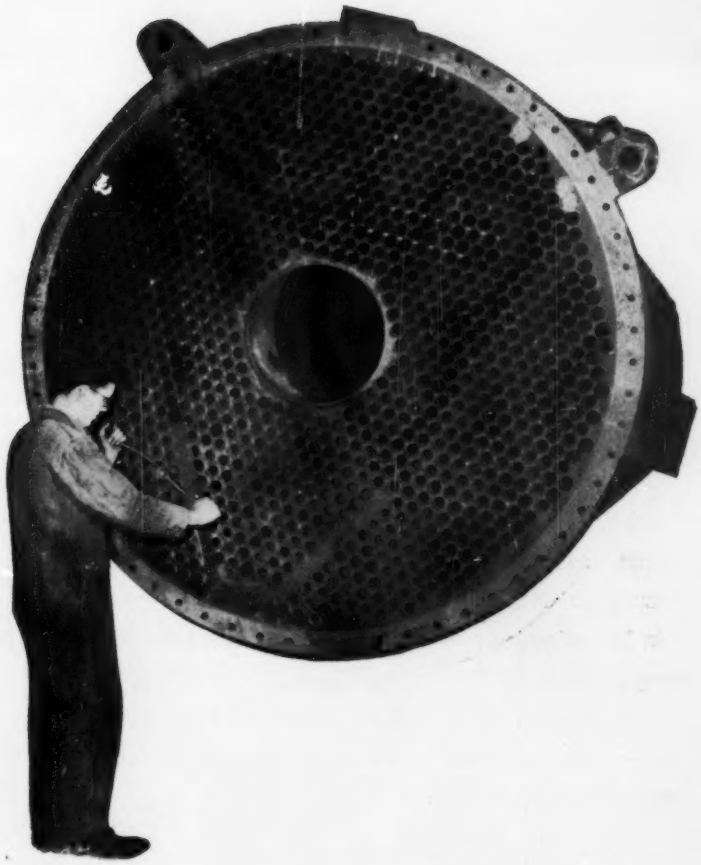

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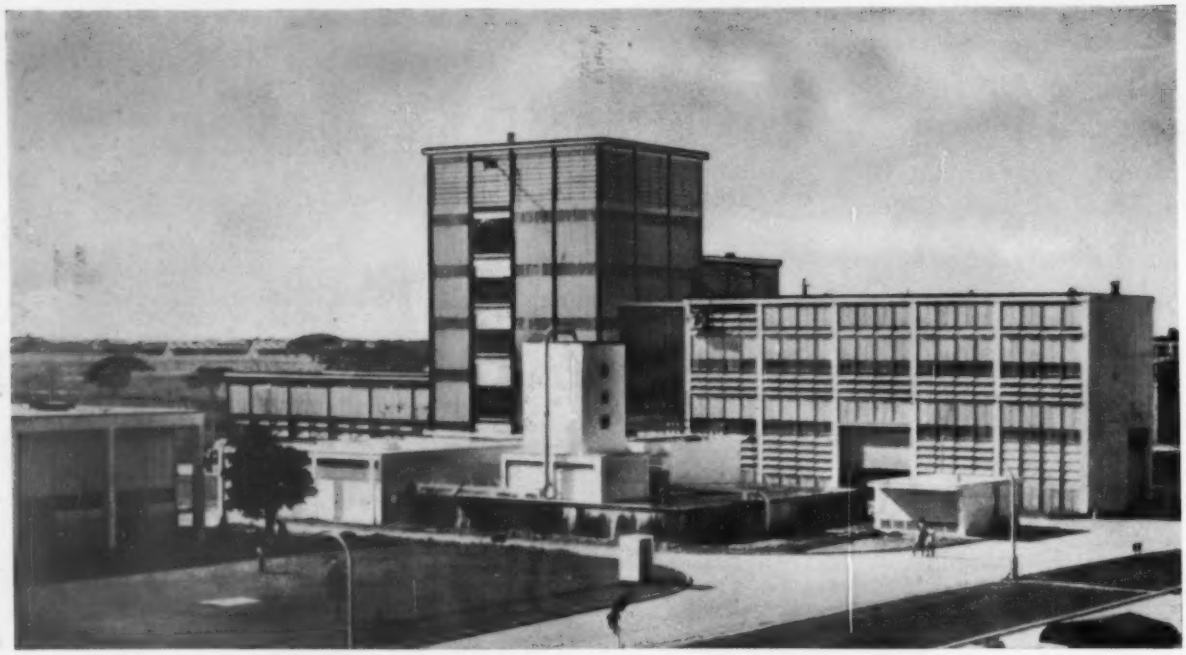

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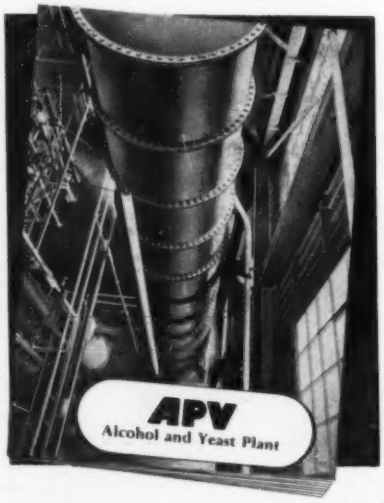

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New Books and Bulletins

Proceedings of the 32nd Annual Congress of the South African Sugar Technologists' Association. 146 pp; 8½ × 11 in. (South African Sugar Technologists' Association, c/o Experiment Station, Mount Edgecombe, Natal, South Africa.) 1959. Price: 30s. 0d.

The latest Proceedings follows the usual pattern in giving a list of contents, officers for 1958/59, members and visitors present, and addresses at the opening of the 1958 Congress in Durban. These are followed by the text of the 16 papers presented to the Congress, and a list of instructions to authors.

* * *

Dégradation des Sucres. 280 pp; 6¾ × 10½ in. (Commission International Technique de Sucrerie, 1 rue Aendoren, Tirlemont, Belgium.) 1959. Price: Belgian Frs. 250.

The 10th Meeting of the C.I.T.S. was held in London in 1957[1], and the Proceedings are assembled in this volume which carries a title expressing the theme of the papers presented. The papers have been abstracted in previous issues of this *Journal*.

* * *

Sugar Sketches. O. H. LAMBORN. 23 pp; 4 × 8¾ in. (Lamborn & Co. Inc., 99 Wall Street, New York 5, N.Y., U.S.A.) 1959.

This small paper-covered booklet is a reprint of the address given by the author before the Annual Convention of the American Chemical Society at Boston, Mass., on April 6th, 1959. He traces briefly the spread of sugar cane throughout the world, the origin of the beet sugar industry and its growth in the U.S.A. Reference is made to the world production and consumption of sugar, and a proposal is made that surplus foodstuffs, including sugar, should be packaged into "food bricks" to be used as a composite nutritional supply for under-developed countries or in emergencies. Other aspects of the production and trade in sugar are touched on, including notes on the U.S. Sugar Act and the International Sugar Agreement, and also mechanization in the sugar industry and the Sugar Research Foundation Inc.

* * *

Sprinkler Irrigation 1959. 379 pp; 6 × 9 in. (Sprinkler Irrigation Association, 1028 Connecticut Ave. N.W., Washington, D.C.) 1959. Price: $7.50.

This edition brings up to date the information contained in the first edition published in 1955 and reviewed earlier[2].

Zuckerwirtschafliches Taschenbuch 1959. (Economic Sugar Pocket Book.) H. MOSOLFF and G. BRUHNS. 163 pp; 4 × 5¾ in. (Verlag Dr. Albert Bartens, Lückhoffstr. 16, Berlin-Nikolassee, Germany.) 1959. Price: DM. 7.20.

The 6th edition of this very handy little book includes 61 tables and 11 graphs illustrating various aspects of the world, European and German sugar industries. As before, the second section gives brief accounts of international and local agreements, while the third includes addresses of German sugar organizations, etc., sugar factories and a list of U.S. sugar companies. An innovation is the inclusion of two tables covering the capacity of Metropolitan France's sugar factories and the sugar consumption of the various confectionery and preserve industries.

* * *

Report of the Rothamsted Experiment Station, 1958. 283 pp; 6 × 9½ in. (The Rothamsted Experiment Station, Harpenden, Herts.) 1959. Price 10s. 0d.

The Report follows the same lines as in previous years[3] offering, in abbreviated form, a summary of the ground covered by, and the technical work of, the 14 Departments based on the Station itself as well as of the associated Stations of Woburn and Dunholme. Of the former Station a special review is given with two further special reviews dealing respectively with some aspects of soil mineralogy and the use of insecticidal seed dressings.

The ground covered is so extensive that the summaries record in bare outline only the general trend of the several investigations; for detail in any particular subject it is necessary to turn to the individual papers of which well over 200 are listed. In fact there arises, in the course of perusal, a growing and uncomfortable feeling that, with the growth of the staff from 140 in 1943 to its present 471, the Station has become so inflated a Colossus that the right hand knoweth not what the left hand doeth. To take one instance only: different aspects of the vexed problem of soil fertility and its maintenance are subjects for study by more than one Department but nowhere is there indicated any clear recognition of the seasonal variation particularly in nitrate N and available P. Yet surely in the determination of the causes of this variation lies the key to a vastly clearer understanding of the fundamental requirements for the maintenance on a permanent basis, and even improvement of soil fertility.

[1] *I.S.J.*, 1957, **59**, 155, 184.
[2] *I.S.J.*, 1956, **58**, 314.
[3] *I.S.J.*, 1958, **60**, 23 and 371.

Study of the Progress of Sugar Crystallization. A. VECHETA. *Listy Cukr.*, 1959, **75**, 84–85, 85–88.—Relationships between crystal size, growth rate, purity of the mother liquor and time of boiling are discussed and analysed mathematically. Equations are developed for simple determination of crystal surface, weight growth per min and crystallization rate, as a function of time, and some relationship illustrated by graphs.

* * *

Nitrogenous Non-Sugars. III. Determination of Glutamine in Sugar Juices. F. SCHNEIDER, E. REINEFELD and H. FORTH. *Zucker-Beihefte*, 1959, **3**, 102–107. A method of determining glutamine in juices is described. This comprises separation of the glutamine by paper chromatography, elution and hydrolysis to glutamic acid, and paper electrophoretic determination of the acid. Adequate separation was effected in 20–24 hr, using 40 : 50 : 10 *n*-butanol : water : glacial acetic acid as solvent. (R_f values are 0·11 and 0·23 for glutamine and glutamic acid respectively.) Elution and hydrolysis is effected within 1 hr by boiling with 5% HCl under reflux. The HCl is largely removed by evaporating under water-jet vacuum. As the resultant solution has a pH of 1–2, there is no conversion of glutamic acid to pyrrolidone carboxylic acid. Ninhydrin is used as reagent (0·1% ninhydrin solution in *n*-butanol with 1% glacial acetic acid added) and the colour determined photometrically at 550 mμ using a green filter. The electrophoresis takes 2 hr, with 0·2N acetate as buffer solution at pH 3·7. Three series of tests were made: (1) with raw juice from a pilot-plant; (2) with juice from a pilot-plant with laboratory-scale purification and evaporation to thick juice; (3) with pilot-plant raw juice, with glutamic acid added. Apart from the glutamine, the glutamic acid and the "total glutamic acid" (after acid hydrolysis) were determined. It was found that a sharper decrease in the glutamine content between the thin and thick juices was accompanied by a higher loss in alkalinity and a greater pH drop. However, no universally valid quantitative relationship could be established. In all 3 series of tests, not all the glutamine was destroyed by juice purification, although more glutamine was decomposed by defecation than by evaporation. That part of the "total glutamic acid" derived from the albumin or residual peptides was small, and the glutamic acid content of defecation juice was only slightly increased. In the defecation test conditions only about 9% of the glutamine and 5% of the pyrrolidone carboxylic acid was identified as glutamic acid. From the results it is found that, even under the defecation conditions, the equilibrium glutamic acid ⇌ pyrrolidone carboxylic acid still tends towards the right, which may be a result of direct conversion into pyrrolidone carboxylic acid of glutamine, caused by ammonia separation.

* * *

Racemization of Glutamic Acid. J. VOSS and I. HAIDASCH. *Zucker-Beihefte*, 1959, **3**, 108–110.—In the production of L-glutamic acid (or its sodium salt) from vinasse by hydrolysing pyrrolidone carboxylic acid, it has been found that the glutamic acid undergoes racemization, having a lower specific rotation than that given for optically pure glutamic acid. Investigations proved that no change occurs during hydrolysis, but that at times about 12% of the total pyrrolidone carboxylic acid in the vinasse, molasses, or thick juice is in its D-form. The glutamic acid from the molasses was shown by the specific rotation determination to be 12·3% D-isomer, while thick juice gave 11·8% D-glutamic acid. Thus it appears that racemization takes place in an earlier stage in sugar production.

* * *

Ion-Sucrose Association in Aqueous Solutions. B. BRUKNER and H. CORDES. *Zucker-Beihefte*, 1959, **3**, 110–120.—From polarimeter readings were derived equations expressing the change in optical rotation of a pure sucrose solutions caused by the presence of salts. All the evidence points to the existence of compounds formed by the addition of ions to sucrose molecules. The change in optical rotation depends on the positions at which the anions and/or cations adhere to the active molecules. Equilibrium exists between the dissolved ions and those which are attached to one or more molecules. If several active molecules are connected to one single ion, the change in optical rotation will be infinitely small. While one anion and one cation can adhere to a molecule, more than two ions cannot do so because of the repulsion potential. Equations are derived for compounds composed of one ion and one active molecule, and one ion and two active molecules, while graphs are drawn to show the dependence of the change in optical rotation on the concentrations of sucrose and salts in the compounds and on the nature of the salt. The change in rotation is greater at higher concentrations, where two sucrose molecules are combined with one anion, as in the case of solutions containing iodides.

* * *

Quantitative Determination of Non-Nitrogenous Organic Acids in Sugar Factory Juices. V. PREY, O. SZABOLCS and I. SZABOLCS. *Zeitsch. Zuckerind.*, 1959, **84**, 192–193.—For quantitative determination of the non-nitrogenous organic acids, the juice is first treated in a cation exchanger ("Amberlite IR 120")

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to extract all free amino acids as well as cations, and then in an anion exchanger ("Amberlite IT 4 B") to extract all non-N acids and pyrrolidone carboxylic acid. The first column is preferably larger than the second to ensure good separation. The anion exchanger is washed with distilled water and then eluted with 50 ml 2N ammonia, the eluate then being treated chromatographically using either methanol : ammonia (9 : 1) as solvent, or ethyl acetate : acetic acid : water (8 : 1 : 1), the latter after adding HCl to the eluate. Either solvent can be used for one-dimensional chromatography or they may be combined for two-dimensional chromatography. A 20 cc solution of 0·1N silver nitrate in phenol is used as spray reagent. The acids appear mostly as white or weakly tinted spots on an ochre background and the reducing acids as dark brown spots. The one-dimensional method does not permit good separation of all acids. As an aid to the quantitative evaluation of the spots a diagram is given showing the logarithm of the amount of acid in intervals of 10 g from 10 to 100 g *vs.* the spot size in sq.cm. Three diagrams are given, one each for the one-dimensional and one for the two-dimensional method. To ensure that all the acids are quantitatively detected, the ammonium salts are titrated directly, in the the eluate, using 0·1 N NaOH as reagent and Alizarin Yellow R as indicator. The total of the acids converted to normalities on dry solids agreed well with the sum normalities on dry solids on the individual acids.

* * *

Characterization of Colour Types. S. PERSSON. *Socker Handl.* II, 1959, **15,** 5–10.—Synthetic coloured solutions were prepared, the first, a caramel, by the action of alkali on invert sugar, and the second, a melanoidin, by the interaction of glycine and glucose. The colour intensity of sugar solutions containing these is illustrated as a function of pH. When treated with active carbon, the colour removal was found to be related to the initial caramel content by the equation y (% decolorization) = 0·5 *x* (caramel % total colour content) + 18. This permits measurement of the caramel colour proportion by conducting a decolorization with carbon. Experiments on decolorization and crystallization of syrups containing caramel, melanoidins, and mixtures of these, with and without addition of 2% KCl showed that the latter had no adverse effect on decolorization with carbon, and also that melanoidin was more strongly retained by the crystals after four affinations.

* * *

Solubility of Sugar in Pure Water. (New Table.) G. VAVRINECZ. *Cukoripar*, 1958, **11,** 326–327; through *S.I.A.*, 1959, **21,** Abs. 200.—Former determinations of ranges of values are quoted from the literature, and 107 good measurements have been used to work out a general formula (by the method of least squares), which is :

$$p = 64{\cdot}3702 + 0{\cdot}08437\ t + 0{\cdot}00185885\ t^2 - 0{\cdot}0000085007\ t^3.$$

Tables of values are calculated in % weight and in parts of sugar to water, from —15°C to + 102°C.

Microscopic Aspect of First Carbonatation Precipitates and Relation with Juice Filtration. M. ROCHE. *Sucr. Franç.*, 1959, **100,** 127–132.—Photomicrographs are presented showing the nature of precipitates obtained using a number of different carbonatation techniques. The effect of these characteristics on juice filtration is discussed. Where precipitates are recycled, the avoidance of high-speed centrifugal pumps is essential, and the importance of equipment dimensions is emphasized.

* * *

Alkali Metal Derivatives of Sucrose. II. Condensation of Sodium Sucrates with Organic Halogen Compounds. W. A. P. BLACK, E. T. DEWAR, J. C. PATERSON and D. RUTHERFORD. *J. Appl. Chem.*, 1959, **9,** 256–265.—Sodium sucrates have been investigated as a means of preparing sucrose derivatives from organic halogen compounds. No reaction has been effected with mono-sodium sucrate and methyl iodide, and this has been attributed to the presence of ammonia or sodamide in the sucrate. A product approximating in composition to a tetra-*O*-allyl sucrose has been obtained in 50% yield from trisodium sucrate and allyl chloride at 122°; allyl sucrose has also been prepared from hexasodium sucrate. Mono-, tri-, penta and hepta-sodium sucrate react with epichlorohydrin at 135° to give in quantitative yield highly cross-linked insoluble polymers of the epoxide resin type; mixtures of sucrose and sodium sucrate also give insoluble polymers. Methoxymethyl sucrose, soluble in water and organic solvents, has been prepared from chloromethyl methyl ether and pentasodium sucrate at 15°. Ethylene dichloride reacts with trisodium sucrate at 122–135° but sucrose is the major product formed. *o*–Chloronitrobenzene does not react. The reactivity of pentasodium sucrate towards a range of organic compounds has been assessed under mild conditions in the presence of dimethoxyethane: (a) alkyl and aryl chlorides in general do not react at 70–75°, but crotyl chloride is an exception and crotyl sucrose has been prepared in 62% yield; (b) acid chlorides and simple anhydrides react readily and 15 crude sucrose esters have been prepared and their solubilities estimated. Terephthaloyl sucrose is a polymer. Complex reactions occur with triphenylmethyl chloride, picryl chloride, 2 : 4–dichlorophenoxyacetyl chloride, α–chloroacetophenone and ethyl mercuric chloride.

* * *

Operation of a Juice Weigher System. G. A. ANDERSON, B. J. RUTHERFORD, and K. A. STUART. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 23–33.—Assessment of the c.c.s. value of cane at Pleystowe was on a "front roller-juice—stick fibre" basis until the introduction of juice scales. Details are given of operational procedure in the new system for determining c.c.s. and its application to cane payment.

Relationship Between Brix and Viscosity for Kalamia Syrups and Molasses. P. G. ATHERTON. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 45–50.—Spindle Brix value and viscosity at 50°C were measured for syrup and A, B and final molasses. The results were all found to be on a smooth curve similar to that found for results given by King for Philippine molasses at 25°C[1]. Examination of the results by plotting log η *vs.* Bx produced a graph with two linear sections meeting at a transition point. The values for molasses produced at the start and finish of the season were found to be spaced apart but the transition point occured at the same Brix (83·5°) and the slopes of the two linear sections were not very different. By taking the averages of these, the viscosity at one Brix could be calculated from the known viscosity at another Brix, since $\frac{\eta}{\eta'} = e^{0{\cdot}118\ (Bx-Bx')}$ for the low Brix and $= e^{0{\cdot}278\ (Bx-Bx')}$ for the high Brix values. Possible reasons for the transition are considered and the most likely thought to be an increase in internal cohesion.

* * *

Brix and Purity of Raw Juices. J. L. CLAYTON. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 131–137.—Preliminary investigations on the effect of dirt on mixed juice Brix[2] were continued and confirmed. The refractometric results were much closer because the instrument used was in better condition than that used previously, but there was a serious discrepancy between spindle and pycnometer Brix values, corresponding to a calibration error of about 0·1°. The pol was little changed by filtration, so that mixed juice purity rose by about 2·4 units to 87·13—higher than the comparable clear juice purity of 86·46. The implications of the effect of dirt in juices, particularly in regard to factory control and the use of the c.c.s. formula, are discussed.

* * *

Determination of Dilution Indicator. R. H. KENT and E. B. G. CAMERON. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 139–142.—The D.I. of a raw sugar is given by water/(100-pol-water) and is thus the ratio of water to non-sugars. To reduce deterioration a penalty was introduced for D.I. above a certain figure, and this increased interest in its determination. Since pol is determinable with ease and reproducibility, the accuracy of D.I. determination depends on that of water analysis and the method laid down in the "Laboratory Manual for Queensland Sugar Mills"—drying in an oven for 3 hr at 105°C and cooling in a desiccator—was found to give results sufficiently variable to give a difference of 5 units D.I. A new mechanical convection oven with hydraulic temperature control to $\pm$ 0·2°C and internal variation not exceeding $\pm$ 1°C was bought and 5 g samples of sugar in an aluminium dish dried at 98–99°C for 8 hr and cooled over SiO_2 gel in a desiccator for 15 min followed by weighing in a rapid projection balance. The new technique was found to increase water determination accuracy to within 0·01% and the D.I. correspondingly by 1 unit or less.

Industrial Exhaustion of (Beet) Molasses. R. PIECK and G. RENS. *Sucr. Belge*, 1959, **78,** 357–374.—Criteria for exhaustion of molasses are discussed and applied to samples of molasses from some of the Belgian factories. It is concluded that to give adequate accuracy, the criteria should take into account more than the sucrose, K, Na and Ca contents and should include the effects of all non-sugars present; since this is not possible at the moment, the criteria, such as sucrose / K + Na + Ca, are only approximate. A second type of criterion is the physical crystallization of sucrose in the laboratory by treatment of the molasses under controlled conditions, as proposed by GRUT[3]. This has the disadvantage that an appreciable interval occurs before the results are available, and the presence of much fine grain in the molasses can result in the purity after laboratory exhaustion not being the minimum purity.

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Dielectrometric Determination of the Moisture in Dioxane-Insoluble Substances. Application to Sucrose and Refined Sugar. L. CAVALLARO and L. FELLONI. *Ind. Sacc. Ital.*, 1959, **52,** 57–67.—The literature of the determination of moisture in sugars is reviewed and it is pointed out that it is difficult to distinguish between free water, bound water, and water included in the crystal. A procedure is described in detail for preparation of pure anhydrous dioxane which is agitated with a sample of sugar and filtered; the dielectric constant of the resulting mixture with water is measured and the water content read from a calibration curve, whence the water content of the sugar can be calculated, with an accuracy of the order of 0·01%.

* * *

Determination of Moisture in Sucrose by Means of a High-Frequency Method. G. LEONARDI, E. MARIANI and B. RUMI. *Ind. Sacc. Ital.*, 1959, **52,** 68–73.—The moisture content of refined sugars is measured by extraction of the water with dioxane and calculation of the water content of the sugar from the variation in dielectric constant of the dioxane. Details are given of the high-frequency apparatus needed to give accurate results.

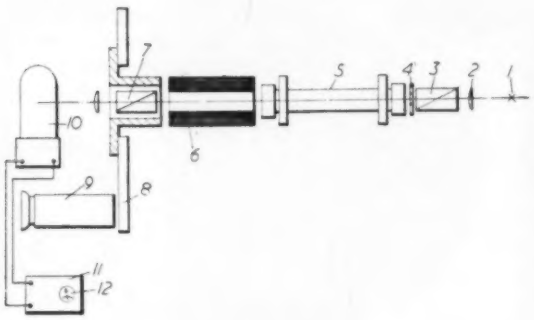
* * *

Relationship Between Brix and Dry Matter in Final Molasses. J. DUPONT DE RIVALTZ DE ST. ANTOINE and J. P. LAMUSSE. *Mauritius Sugar Ind. Research Inst. Ann. Rpt.*, 1958, 100–103.—The SIJLMANS formula[4] for dry matter in molasses is examined for Mauritius conditions and modified to: Dry matter = Brix 1:10 (w./v.) — 0·43 sulphated ash % — 5·8 which is more suitable for calculation of true purity for comparison with the Douwes Dekker purity[5].

[1] *I.S.J.*, 1933, **35**, 187.
[2] DEICKE: *I.S.J.*, 1959, **61**, 191.
[3] *Zucker*, 1953, **6**, 411; *I.S.J.*, 1954, **56**, 19.
[4] *I.S.J.*, 1933, **35**, 116.
[5] *S. African Sugar J.*, 1949, **33**, 709; *I.S.J.*, 1950, **52**, 122.

UNITED KINGDOM

Polarimeters. BELLINGHAM & STANLEY LTD., of Hornsey Rise, London, N.19. **813,579.** 27th March 1956; 25th March 1959.—Light from source 1 passes through a condenser lens system 2 and through the polarizer 3. It is directed through aperture plate 4 into the sample tube 5 and thence through the oscillator 6. This is in the form of a



Faraday cell energised by variable or alternating current, or a rotating Poynting plate device so as to cause alternation of the plane of polarization about a mean position which is the plane of the beam entering the device 6. It passes through an analyser 7 mounted in a frame carrying the scale 8 which is observed through the optical magnifier 9. The light meanwhile passes through the analyser and is focussed on the cathode of the photocell, consequently producing a current having a sinusoidal component at a frequency dependent upon that of the oscillator device 6. The amplifier 11 is tuned to this frequency and any unbalance recorded as a function of the amplifier output by dial 12. In use, the position of the analyser is adjusted when the sample tube 5 is empty so as to give a minimum reading on dial 12. The sample is placed in position and the analyser adjusted until the reading of dial 12 is again at a minimum. The differences in readings on scale 8 show the polarization of the sample.

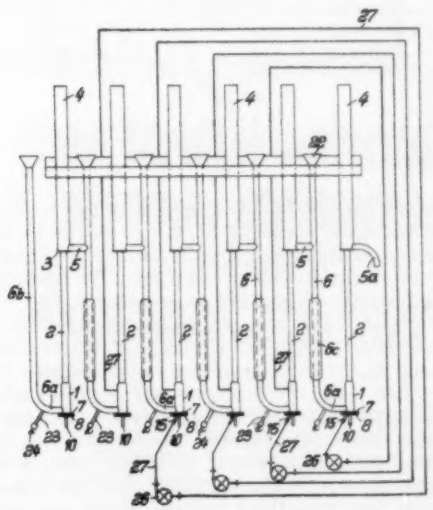
* * *

Feed for Ruminant Animals. SUGAR RESEARCH FOUNDATION INC., of New York 5, N.Y., U.S.A. **815,317.** 30th January 1956; 24th June 1959.—Finely divided sugar beet pulp is ammoniated between about 500 and 800 mm mercury pressure and between about —30° and +50°C to give animal fodder.

Beet Cleaner and Piler. SILVER ENGINEERING WORKS INC., of Denver, Colo., U.S.A. **815,953.** 12th September 1957; 1st July 1959.

* * *

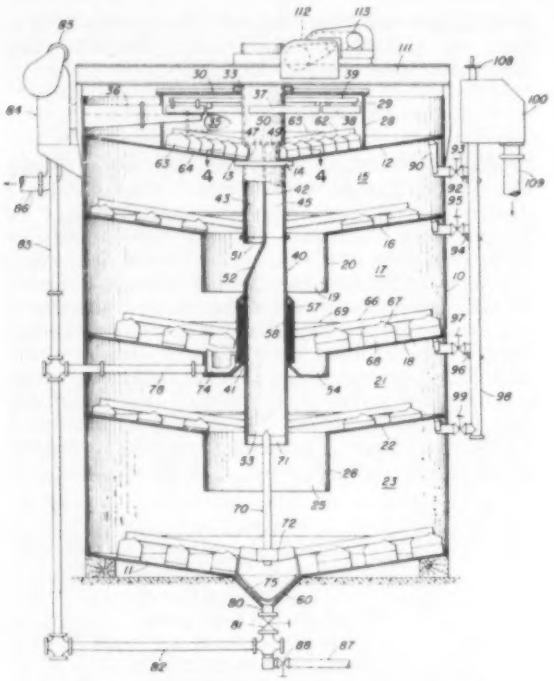
Progressive Treatment of Liquids, e.g. Sugar Juices, with other Liquids and Gases. (Carbonatation.) BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **816,677.** 19th September 1955; 15th July 1959.—Raw juice is fed to the first of a series of funnels into the feed tube 6b to the left of the illustration. It enters the reaction chamber 1 and passes up the rising chamber 2, passing through plate 3 into the foam chamber 4. It overflows into tube 5 and so enters the second feed tube which acts also as a stabilization chamber and is provided with a heating jacket 6c. The bottom of chamber 1 is fitted with flanges 7, 8 and has a gas tube 10 inserted which delivers into chamber 1 in which there is a



baffle to break up the gas bubbles. Another feed tube not shown enters the side of chamber 1, carrying a liquid reagent (e.g. milk of lime) supplied from a gallery parallel with the series of tubes. Final treated liquid leaves the last chamber through overflow 5a and goes to process. Feed can be sampled through pipes 23 with cocks 24 and juice can be withdrawn from the latter chambers 1 by outlets 15 and sent by pumps 26 to pipes 27 leading either to previous reaction chambers or to previous inlet funnels 22.

UNITED STATES

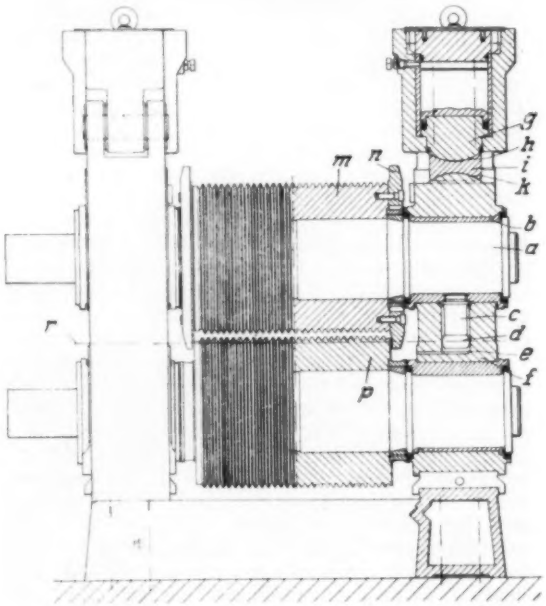
Clarifier. R. H. VAN NOTE, assr. DORR-OLIVER INC., of Stamford, Conn., U.S.A. **2,889,927.** 29th April 1955; 9th June 1959.—Sugar juices to be clarified enter the feed chamber 29 of the clarifier illustrated by means of a tangential pipe having an outlet 35.



A certain amount of settling takes place in this feed chamber, while scum and foam also rise to the surface to be scooped into trough 36 by paddles 37, 38 rotating with the central tubular shaft 40. The juice passes through ports 47 and 49, of equal area, and so into conduits 43 and 45, since mixing is prevented by means of seal 50 and baffle 42. Conduit 43 delivers through opening 51 into the upper pair of chambers 15 and 17 which are clarification and clarification-and-thickening chambers respectively. Conduit 45 similarly discharges through opening 53 into corresponding chambers 21 and 23. Clear juice is drawn through pipes 92, 94, 96, and 98 to the box 100 which contains level controls for governing the rate of withdrawal from each compartment, and thence to process through pipe 109. Muds settling in feed chamber 29 are scraped into ports 47 and 49 by the rotating blades 63 carrying squeegees 64, while similar blades with squeegees carry muds from chamber 15 into the well formed by the cylindrical baffle 20. Muds from chamber 17 are similarly scraped into mud boot 54 and withdrawn through pipe 78. Muds from chamber 21 are sent through the well formed by baffle 26 and muds from chamber 23 pass into the mud well 60 from which they are withdrawn through pipe 80. The muds, foam and scum are drawn by the mud pump 84 and discharged through pipe 86. The bottom scrapers are carried on arms supported from the shaft 70 and this is held by a spider 71 in the bottom of tubeshaft 40.

* * *

Roller Mill Bearing. H. K. BUSECRUS, assrs. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **2,890,647.** 10th September 1954; 16th June 1959.—A roller axle *a* with its bearing *b* carries on its under side an arm *c* with a spherical body *d* which is vertically slidable and at the same time oscillatably guided in a bore *e* in the stand *f*. A pressure piston *g* is slidable in the stand *f* above the bearing *b* and bears against a spherical surface *k* of the bearing *b* through the intermediary of a spherical surface *h* and a double concave intermediate member *i*. The roller *m* carries a juice flange *n* which overlaps a sector of the end face of the counter roller *p*.



As soon as the roller *m* tilts under the influence of the material being crushed and the bearing *b* assumes a correspondingly inclined position, this bearing *b* is guided by means of arm *c* carrying spherical body *d* so that spherical body *d* is guided in the bore *e* in such a manner that the gap between the juice flange *n* and the roller sector or edge remains practically unchanged in width. This avoids the difficulty which has occurred where the flange-roller gap has either narrowed or expanded as the roller inclination increases, causing either breakage of the flange or passage of the bagasse through the gap.

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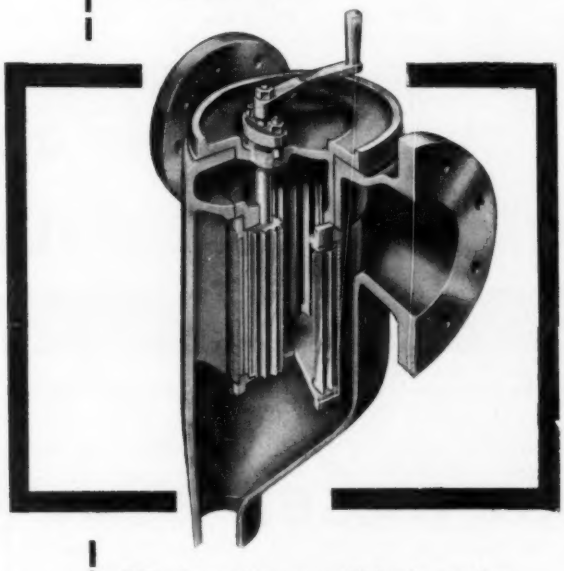

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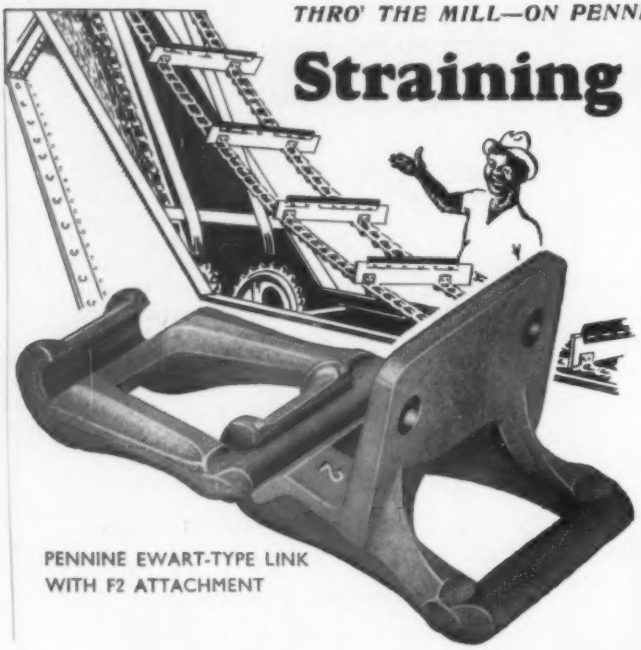

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TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Sugar Tableting Machine. Goka N.V. Machinefabriek, P.O. Box 130, Amsterdam C., Holland.

The equipment consists of a hexagonal mixing drum in which 100 kg of sugar is mixed with about 1 kg of distilled water or 2 kg of sugar syrup during 5–10 minutes. The mixture passes through a chute to the automatic tableting machine where it is placed in the matrix holes and moulded between upper and lower dies. The thickness of the tablets may be adjusted on the machine while replacement of the dies permits the production of tablets of different sizes. Output varies with the size but the machine will produce, e.g., 17,280 per hour of tablets 34 × 34 × 26 mm, weighing 425 kg, or 69,120 tablets 15.2 × 15·2 × 15·2 mm, weighing 260 kg. The pressure used is adjustable to give hard or quickly-soluble lumps or cubes. The tablets are led to a moving belt and pass first through an infra-red dryer and then through a cooler. They are cleaned of sugar dust by an automatic suction device. The machine produces tablets of very accurate size and can be fed with normal sugar from the centrifugals or moist sugar from storage. Maintenance is about 90 man-hours per year and one man can control a battery of four machines.

* * *

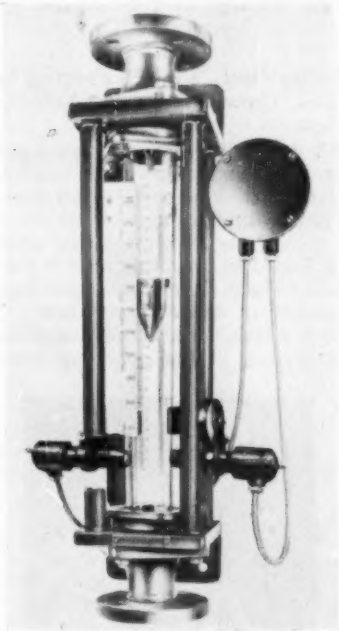
The "Powertiller" Cultivator. Markham Traction Ltd., Lincolnshire Ironworks, Stamford, Lincs.

The "Powertiller" mounted rotary cultivator is available in 50-inch and 60-inch working widths and has three unique features: the same machine can be offset or centrally mounted on the tractor; a

two-speed rotor is fitted as standard equipment, the change being easy and taking less than thirty seconds; and the specially-designed blades give greatly improved soil pulverization and make the machine easier for the tractor to drive.

Photo-Electric Alarm for Industrial Rotameters. Rotameter Manufacturing Co. Ltd., Purley Way, Croydon, Surrey.

The alarm comprises a light source and a photoconductive cell, each housed in an identical black plastic moulding which clamps to diametrically opposed pillars of the chassis with independent adjustment of the height of the alarm and of the axes of



the lamp and photocell. The resistance of the photocell changes with the amount of light falling on it. Interruption of the light beam by the float causes a change in current and operates a relay coupled to a mirror switch. The separate relay box contains mains transformer, alarm relay, and rectifier.

* * *

Continuous-Flow Refractometer. Hilger & Watts Ltd., 98 St. Pancras Way, Camden Road, London, N.W.1.

The Hilger continuous-flow refractometer makes a continuous comparison between a reference liquid and a flowing sample. Any change in the concentration of the sample is shown on a meter or recorder. If desired, the instrument can be incorporated in an automatic control system to restore the concentration of the sample to the correct level.

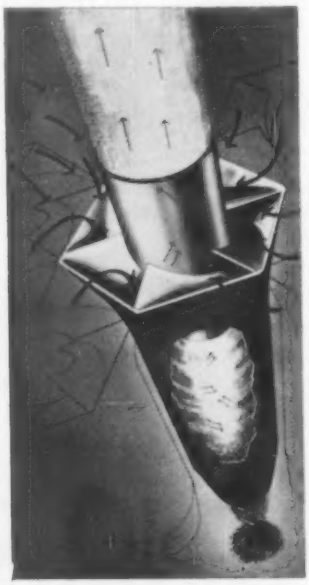
The refractometer uses a null-balance system of measurement; and any change in the refractive index of the sample unbalances the system. A simple servo mechanism restores the balance and indicates the difference between the indices of the sample and reference liquids. The cell unit containing the two liquids is made from stainless steel and is surrounded by a bath of water, which helps to maintain the cell at a constant temperature. When very high accuracy is required the reference liquid and the water in the bath may both be circulated through an external heat exchanger.

The instrument is particularly suitable for continuous monitoring in process-control systems and has many advantages over manual methods of sampling and measuring. It saves time and manpower, and cuts the wastage of material due to inefficient control.

* * *

Dust Collecting Plant. Steels Engineering Installations Ltd., Crown Works, Sunderland, Co. Durham.

The SPA dust collector comprises a number (depending on volume requirement) of standard elements within a fabricated steel body with a dust collecting hopper. Each standard unit comprises two parts, the outer member being a cylindrical collector tube to which is joined an operating zone in the form of a funnel which reduces from a hexagonal section to the circular section of the collector tube. The inner member is a coaxial central tube extending a little below the bottom of the operating zone, and six



deflector vanes are welded to the inside of the hexagonal section so as to fill the space between this section and the inner member, leaving gaps through which dust-laden air is guided, in a helical path. The decreasing diameter of the funnel causes a rapid increase in air speed, and the solid particles are thrown to the periphery of the outer member by centrifugal force, falling under gravity and being collected at the bottom, in the hopper. Approximately two thirds of the way down the collector tube the air flow reverses up the central core of the vortex and leaves the element through the inner member, in which another vane restores straight flow.

* * *

PUBLICATIONS RECEIVED

CROFTS FREE SPACE HYDRAULIC COUPLINGS AND DRIVES. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorks.

Publication I–5914 gives details including a power table and dimensions of pulley-driven (Type FSP) and direct-coupled (Type FSC) hydraulic couplings which are available from stock up to 100 h.p. at 1450 r.p.m. and are also available for powers up to 700 h.p.

* * *

CANE SUGAR MILLS. Maschinenfabrik Buckau R. Wolf A.G., Grevenbroich-Neuss, Germany.

Leaflet F 1116 describes and illustrates the individual parts of milling tandems supplied by Buckau-Wolf : Cane carrier, cane knives, chain, cane chute, kingboltless mills, engine, turbine or electric motor drive, intermediate carrier, vibrating juice strainer, bagasse chute, vibrating screen, bagasse elevator and carrier, and bagasse burning furnace.

* * *

CHAIN GRATE ASH EXTRACTOR. Riley (I.C.) Products Ltd., 19 Woburn Place, London W.C.1.

A recently introduced automatic ash extractor has been developed for installation with most sizes of Riley "T" Chain-grate stokers. It is of the conveyor type, the ash lying stationary on the apron plates which travel at a constant speed of $3\frac{1}{8}$ in/min under the action of a fractional h.p. motor. The conveyor discharges to an ash box or ash-chute, to a water trough conveyor or to a draw plate for discharge to a trolley. A steam cleaning assembly is fitted.

* * *

CURRENT OVERLOAD AND UNDERLOAD RELAYS. Elcontrol Ltd., Wilbury Way, Hitchin, Herts.

A new Data Sheet, OR/UR, describes electronic control units suitable for e.g. stopping a cane carrier when the load on a crusher motor is over the desired limit, or increasing supplies to a process when the load drops below a required limit. The completely enclosed unit measures only $13 \times 8\frac{1}{2} \times 6$ inches and is fitted with a signal lamp, and controls for setting the overload or underload value and for controlling the reset or differential value.

* * *

MECHANICAL HANDLING. Crone & Taylor (Engineering) Ltd., Sutton Oak, St. Helens, Lancs.

A new 16-page brochure illustrates and gives performance and design specifications and dimensions of the Crone & Taylor range of handling equipment, including the "Beaver" and "Mobiveyor" bulk stackers, the "Badger" bag stacker, "Walrus" stackers and feeders, "Meteor" mobile and suspended throwers, bagging and screening units, disintegrators and unit conveyors.

* * *

IN-LINE HELICAL GEAR SPEED REDUCERS. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

Book 2751 contains information on the complete Link-Belt line of helical gear speed reducers which comprises 20 reducer sizes in double, triple and quadruple reductions. The book contains tables of load classes and service factors, h.p. and torque ratings, dimensions, etc., and also selection data on motor couplings and geared flexible couplings designed for use on the speed reducers.

BREVITIES

Bulk Handling in the Dominican Republic.[1]—A bulk raw storage and ship loading facility of high capacity has been installed by Buhler Brothers of Switzerland at Rio Haina in the Dominican Republic. Two chain conveyors bring sugar from each centrifugal battery to two vertical bucket elevators carrying the sugar to automatic scales. Two chain conveyors in series deliver across and under the roofs of the four bays of the warehouse into which the sugar is distributed by cross conveyors running the lengths of the bays. Sugar is reclaimed by floor belt conveyors feeding a collector belt which takes the sugar to a weighing tower on the wharf from which it passes to three stationary loading towers which have swinging booms carrying telescopic chutes down which the sugar drops to a suspended trimmer. The store can be loaded at 120 tons/hr, while peak withdrawal rate is 550 tons/hr.

* * *

New Sugar Refinery in South Africa.[2]—Early in June the Umfolozi Cooperative Sugar Planters' refinery at Riverview, Zululand, was officially opened, and it is hoped this year to refine the total white sugar quota of 55,000 tons. The melt sulphitation process has been adopted and has been an unqualified success. The whole clarification and melting plant at Umfolozi operates automatically; rate of flow, temperature, densities and pH are instrument-controlled.

* * *

Bulk Handling in Australia.[3]—When he officially opened the new bulk sugar terminal at Townsville, which has a storage capacity of 150,000 tons, the Premier of Queensland, (Hon. G. F. R. NICKLIN, M.L.A.) announced that a bulk sugar terminal was also planned for Cairns, but this would not be built until those buyers who still required bagged sugar were ready to operate on the bulk system.

European Beet Sugar Production[4]

(metric tons—raw value)

	1959/60	1958/59	1957/58
Germany, West	1,425,000	1,915,000	1,583,848
,, East	725,000	933,000	852,222
Germany	2,150,000	2,848,000	2,436,070
Austria	290,000	296,251	284,231
Czechoslovakia	860,000	900,000	879,790
Hungary	385,000	299,200	275,656
France	1,150,000	1,600,000	1,572,221
Belgium	250,000	465,453	383,779
Holland	510,000	587,142	394,819
Denmark	260,000	400,000	367,000
Sweden	302,000	268,400	331,070
Poland	1,100,000	1,211,110	1,178,442
Italy	1,125,000	1,143,528	864,629
Spain	491,000	447,432	332,634
Yugoslavia	275,000	196,200	261,400
Roumania	300,000	225,000	213,831
Bulgaria	165,000	132,000	149,539
Switzerland	35,200	37,164	38,667
Great Britain	825,000	815,665	625,616
Irish Republic	132,500	113,547	122,388
Finland	41,000	39,015	32,061
Turkey	470,000	388,248	356,111
Europe excluding U.S.S.R.	11,116,700	12,413,355	11,099,954
U.S.S.R.	5,880,000	6,260,000	4,900,000
Europe including U.S.S.R.	16,996,700	18,673,355	15,999,954

Beet Factory for Argentina.[5]—The Governor of the Argentine Province of Entre Rios has announced that there will be a tender for erection of a beet sugar factory and alcohol distillery on 26th September 1959. The factory is to have an annual capacity of 2500 tons of beet sugar.

* * *

West Indies Sugar Production and Consumption.—The British West Indies Sugar Association released the following data on 5th September 1959:

CROP RESULTS AND FORECASTS:

(*long tons*)

	Production 1957	1958	*Estimate* 1959
Antigua	31,670	21,983	‡28,695
Barbados†	204,525	152,847	‡184,152
British Guiana	284,973	306,361	290,500
Jamaica	359,067	345,535	378,075
St. Kitts	44,794	42,169	‡46,790
St. Lucia	9,314	8,198	‡6,931
Trinidad	167,805	187,500	‡181,131
St. Vincent	3,557	4,281	‡4,122
	1,105,705	1,068,874	1,120,396

LOCAL AND NEIGHBOURING CONSUMPTION:

(*long tons*)

	1957	1958	1959	*Estimated Available for Export* 1959
Antigua	1,319	1,597	1,586	27,109
Barbados†	11,292	12,038	10,346	*174,672
British Guiana	18,812	18,723	18,500	*275,783
Jamaica	60,000	60,934	59,848	*318,277
St. Kitts	4,104	4,648	4,800	41,990
St. Lucia	1,750	1,907	1,921	5,010
Trinidad	26,093	27,808	30,000	*151,495
St Vincent	2,751	2,902	3,000	1,132
	126,121	130,557	130,001	995,468

* Includes stock at end 1958.
† Production and export figures include Fancy molasses.
‡ Final.

* * *

Cane Sugar Production Potential in the Sudan.[6]—A survey released by the Government of the Sudan was prepared by the Tudor Engineering Co. to alert U.S. companies to the investment potential which exists in that Sudanese industry. A sugar plantation capable of producing 9,000 feddans (9342 acres) of sugar cane and a sugar mill with an annual capacity of 34,000 metric tons of refined sugar is proposed as an initial step in the development of the industry. Total imports of sugar into the Republic of the Sudan in 1957 amounted to 106,800 tons.

Estimates made by the Commerce-ICA survey team in the autumn of 1958 indicate that the enterprise will require an investment of about US $11·9 million, including necessary field equipment, factory construction, and essential auxiliary facilities. Managerial and technical assistance also are required for the project.

A number of locations are adaptable to sugar cane production. These include sites at Kosit or Sennar, proposed site for the initial mill; an area south of Kosit on the west side of the White Nile; Abu Na'Ama on the Blue Nile; Mongalla in Equatoria Province; and Jebel Moya on the Sennar Junction-Kosit rail line.

[1] *Sugar y Azúcar*, 1959, **54**, (9), 32–33.
[2] *Commonwealth Producer*, 1959, (373), 156.
[3] *Queensland Newsletter*, 1st October 1959.
[4] F. O. LICHT, *International Sugar Report*, 1959, **91**, (9), 81.
[5] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 18), 244.
[6] *Willett & Gray*, 1959, **83**, 377–378.

BREVITIES

Nyasaland Polder Project.[1]—The NEDECO survey team, which has just completed a preliminary survey of the Elephant marsh in southern Nyasaland, is to suggest to the Nyasaland Government a 5000-acre pilot polder within a potential area of 60,000 acres which could be reclaimed in ten years at a cost of £5m. It is considered that this scheme could produce sugar cane, cotton, rice, maize and other crops worth about £2m a year and possibly supply all Nyasaland's requirements of sugar.

International Sugar Agreement Quota Surrenders

On 1st October 1959 the International Sugar Council announced that a total amount of 251,196 metric tons raw value had been surrendered by Indonesia, Haiti, Portugal and the U.S.S.R. Since then, France has surrendered its entire quota in effect i.e. 18,754 metric tons raw value. The total amount of 269,950 metric tons raw value was redistributed on 8th October 1959 in accordance with the provisions of Article 19(1)(i) of the Agreement.

For the information of all concerned, details of the redistribution and quotas of countries with basic export tonnages under the Agreement as a result of that redistribution are given below:—

Country	*Quotas in effect* 17.6.59	*Surrenders under Art.* 11(2)	*redistribution of* 269,950 *tons*	*Quotas following redistribution in previous column*
Belgium	46,074		2,742	48,816
Brazil	460,735		27,419	488,154
China (Taiwan)	624,693		32,653	657,346
Cuba	2,073,045		120,392	2,193,437
Czechoslovakia	225,000		13,710	238,710
Denmark	39,375			39,375
Dominican Republic ..	548,693		32,653	581,346
France	18,754	18,754		0
Haiti	42,196	42,196		0
Hungary	36,000			36,000
Indonesia	200,000	100,000		100,000
Italy	0			0
Mexico	62,828		3,738	66,566
Kingdom of the Netherlands	0			0
Peru	392,000		24,428	416,428
Philippines	41,442		1,247	42,689
Poland	201,000		10,968	211,968
Portugal	9,000	9,000		0
U.S.S.R.	167,540	100,000		67,540
Total	5,188,375	269,950	269,950	5,188,375

Quotas in effect of countries whose quotas are increased by the amounts in column 4 are provisional pending acceptance of the reallocation by those countries within the time limit provided for in Article 19(1)(i).

Czechoslovakia, Peru and Poland, which had either not accepted increases in (Czechoslovakia and Poland), or had surrendered a part of (Peru), their quotas, notified the Council, following the reduction of quotas on 17th June 1959, that they wished to participate in any further redistribution of surrenders.

Indian Sugar Production, 1958/59.[2]—Total sugar production for the 1958/59 season, as on 31st July, was 1,904,000 tons according to a Press note issued by the Indian Sugar Mills Association.

* * *

Cuba-United Arab Republic Commercial Agreement.[4]—The United Arab Republic and Cuba have recently signed a "Most Favoured Nation" commercial agreement. According to press reports the U.A.R. delegation has suggested that a textile factory should be set up in Cuba and a sugar refinery in Port Said in order to facilitate trade relations.

* * *

Sugar Refinery in Malaya.[3]—A company to be known as the Malayan Sugar Refining Company, with a capital of £1·8 million, has been formed to operate a sugar refinery which will be built by the Nisshin Sugar Refinery of Japan and the Mitsui Bussan Trading Co. in collaboration with Cook Bros., a Malayan firm. Japan will contribute 55% and Malaya 45% of the capital. The company will import raw sugar and distribute the refined product in the Malayan market. The capacity of the refinery will be 120,000 tons a year.

Stock Exchange Quotations

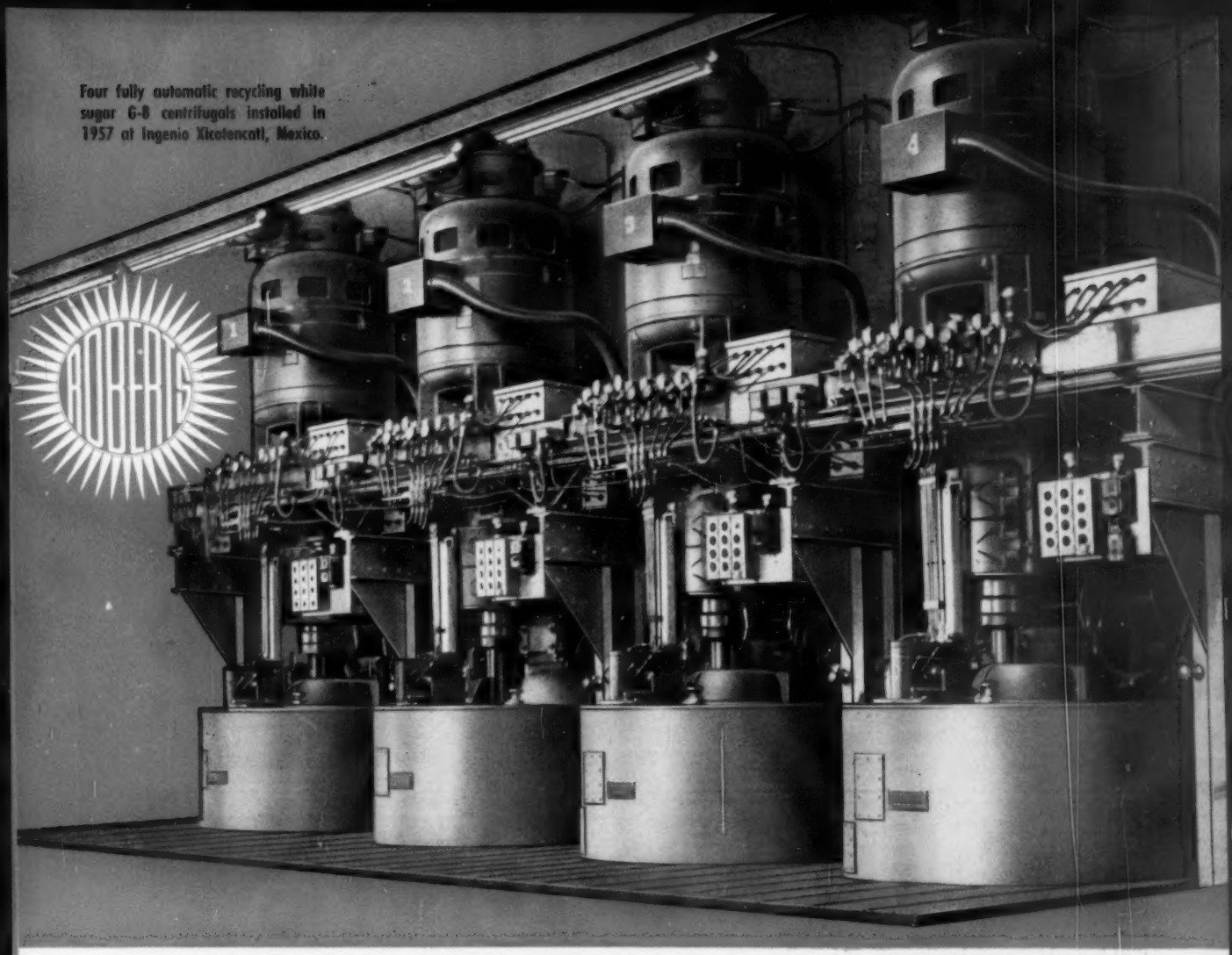
London Stocks (*at 16th October*, 1959)

	CLOSING MIDDLE
Anglo-Ceylon (5s)	16/9
Antigua Sugar Factory (£1)	16/3
Booker Bros. (10s)	27/–
British Sugar Corp. Ltd. (£1)	20/4½
Caroni Ord. (2s)	4/9
Caroni 6% Cum. Pref. (£1)	18/–
Distillers Co. Ltd. (6s. 8d. units)	32/3
Gledhow Chaka's Kraal £1)	63/9
Hulett & Sons (£1)	83/–
Jamaica Sugar Estates Ltd. (5s units)	11/6
Leach's Argentine (10s units)	13/3
Reynolds Bros. (£1)	64/–
St. Kitts (London) Ltd. (£1)	66/–
Ste. Madeleine (Ord.) (£1)	30/3
Sena Sugar Estates Ltd. (10s)	34/–
Tate & Lyle Ltd. (£1)	54/–
Tate & Lyle Investments Ltd. (5s)	17/–
Trinidad Sugar (5s stock units)	27/6
United Molasses (10s stock units)	41/6
West Indies Sugar Co. Ltd. (£1)	20/3

New York Stocks (*at 15th October* 1959)

	CLOSING MIDDLE $
American Crystal ($10)	40¾
Amer. Sugar Ref. Co. ($100)	30⅛
Central Aguirre ($5)	22⅝
Cuban American ($10)	19½
Great Western Sugar Co.	27⅛
South P.R. Sugar Co.	20½
United Fruit Co.	26⅛
West Indies Sugar Corp. ($1)	38

[1] *Commonwealth Producer*, 1959, (373), 169.
[2] *Public Ledger*, 12th September, 1959.
[3] *Commonwealth Producer*, 1959, (373), 169.
[4] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 17), 232.



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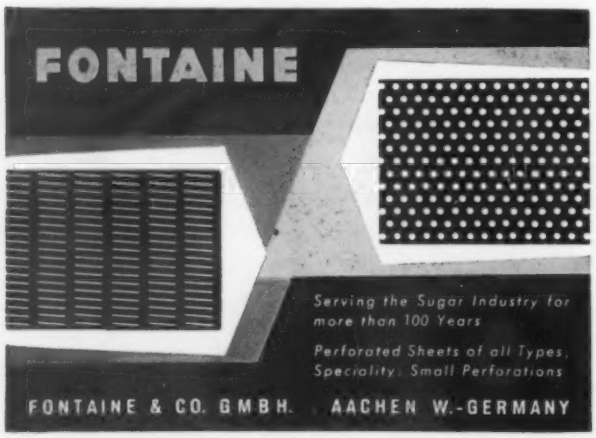
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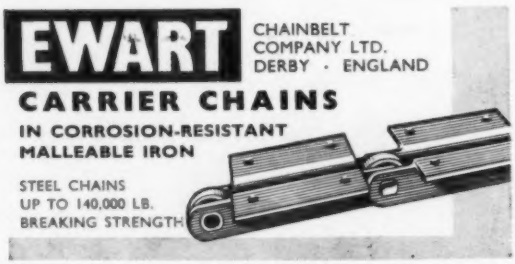

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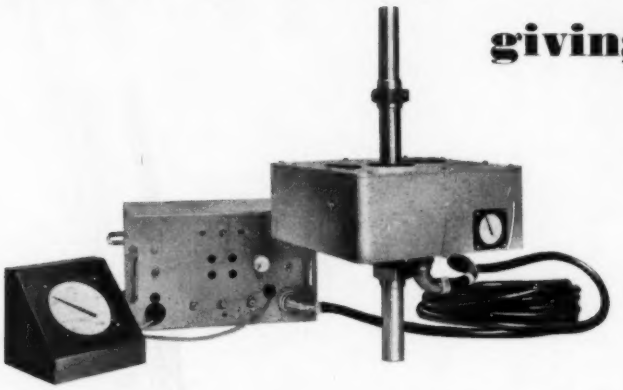

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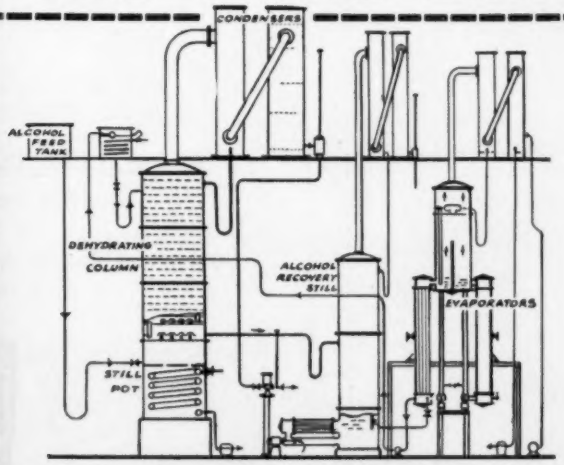

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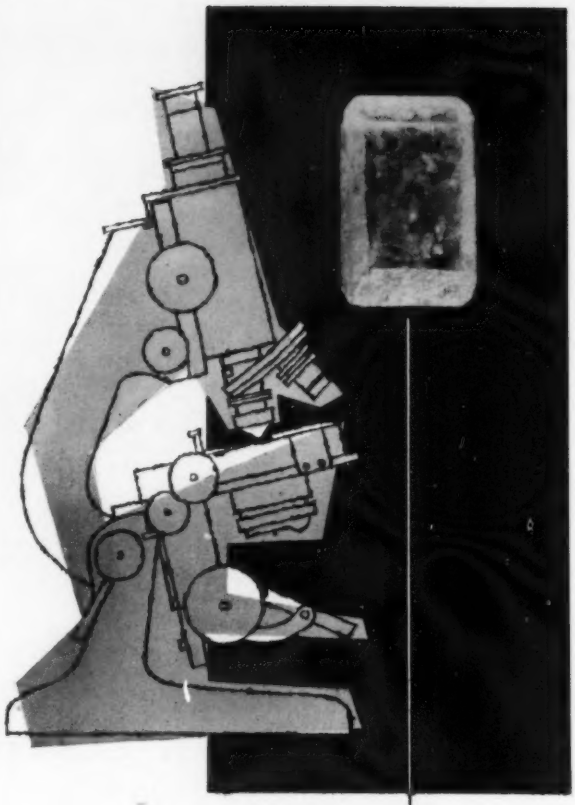

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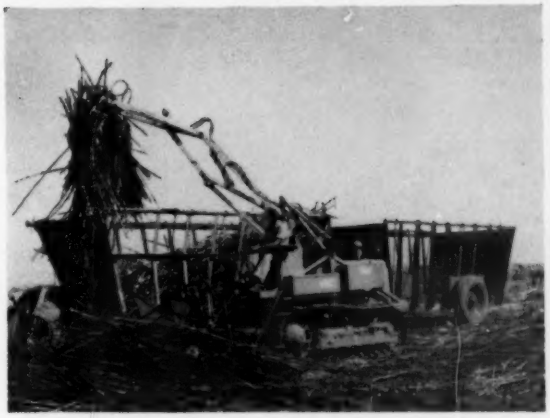

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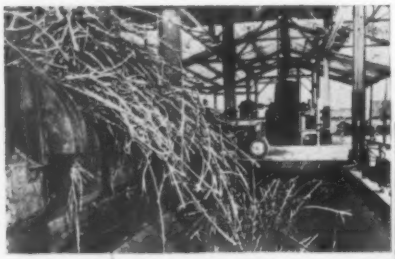

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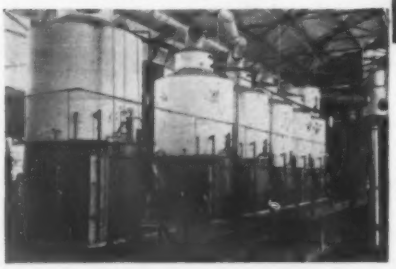

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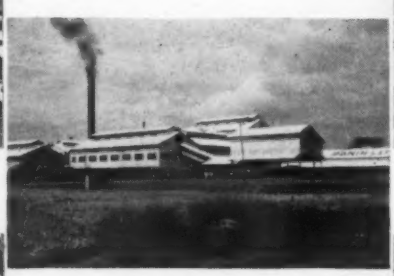

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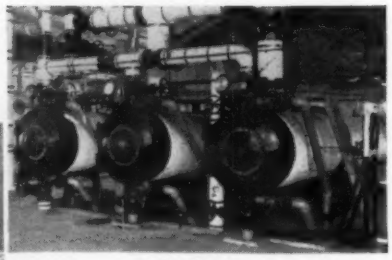

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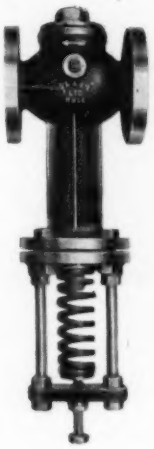

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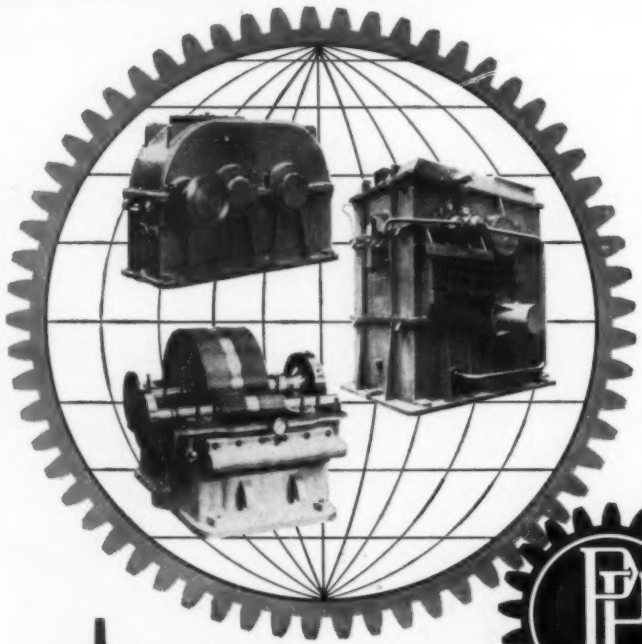

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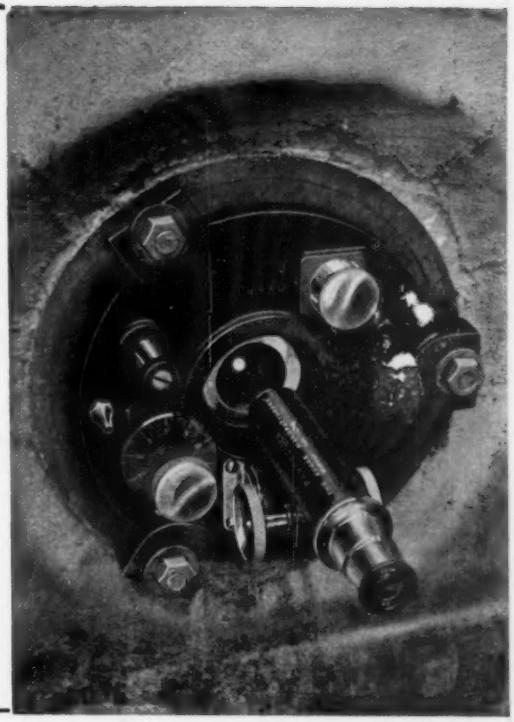

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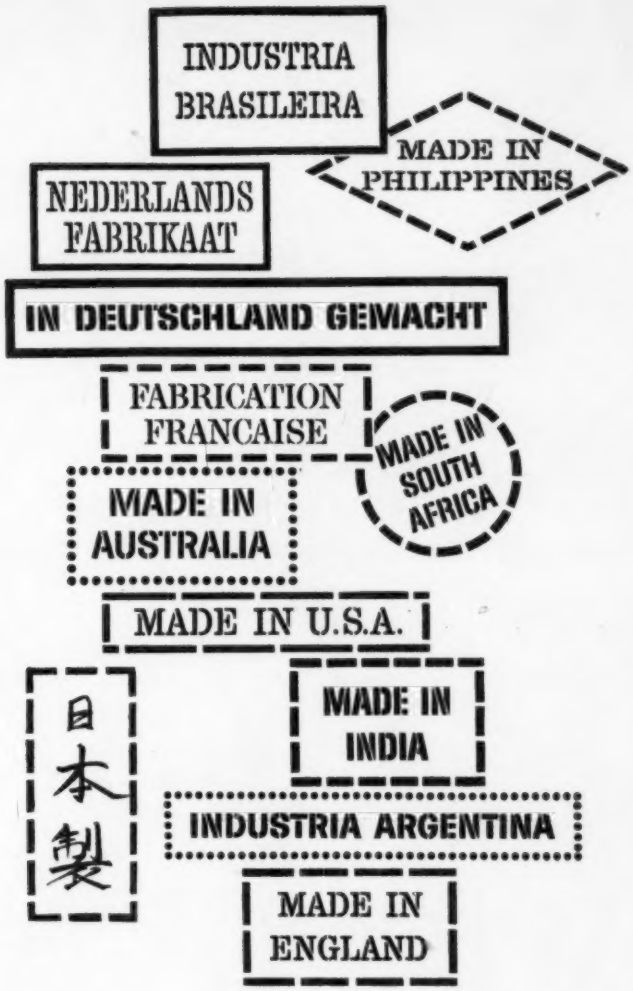

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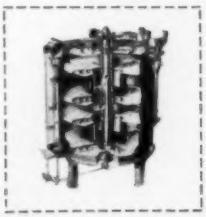

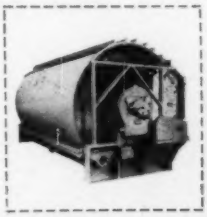

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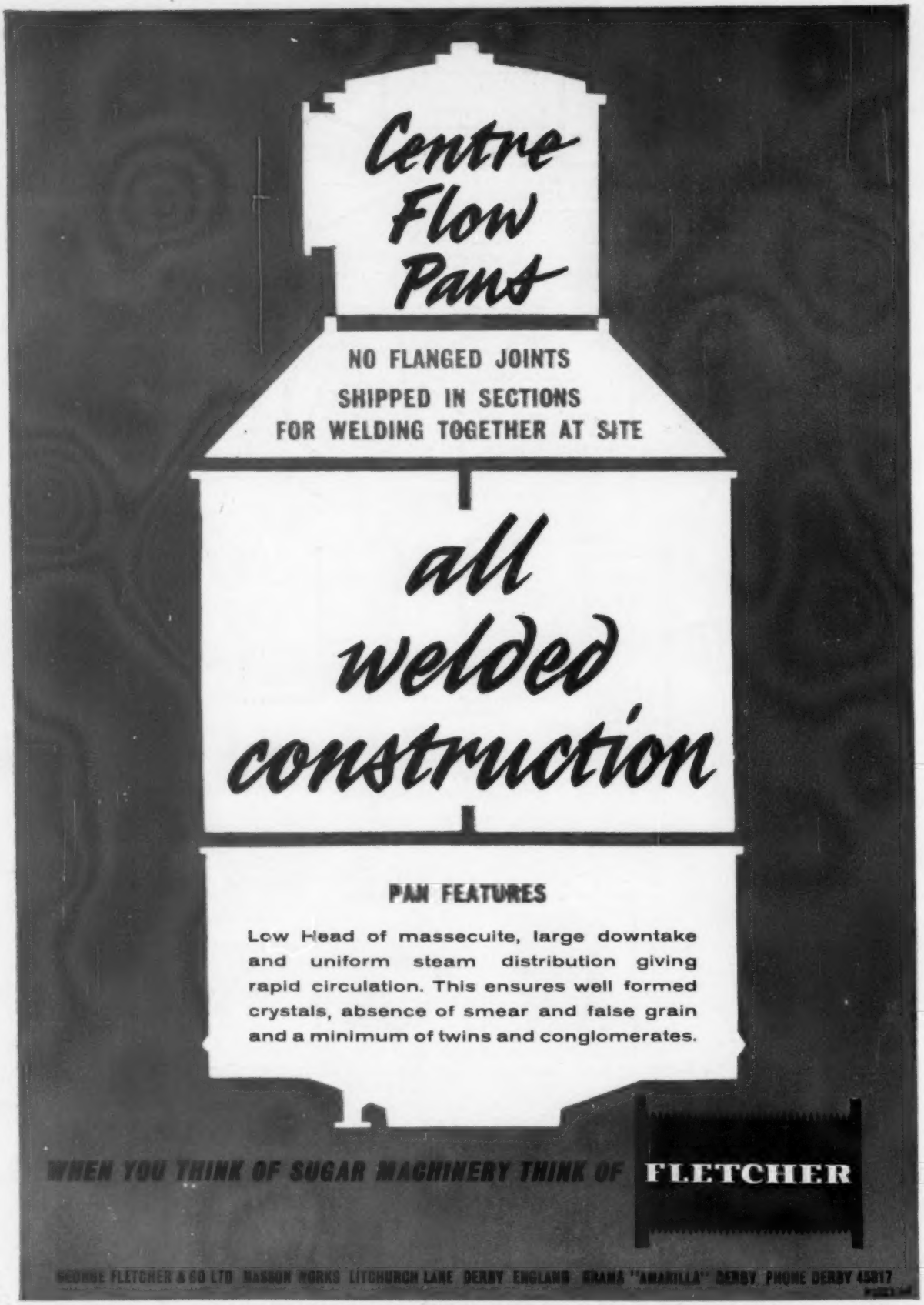
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